BC

Ministry of Environment

# Physical Shorezone Analysis of the Saanich Peninsula

**MOE Technical Report 9**

ISSN 0821-0942

5-3872/

BC
E5
C

M638.9
1984
c.5

Ministry of Environment

MOE Technical Report 9

# PHYSICAL SHOREZONE ANALYSIS OF THE SAANICH PENINSULA

D.E. Howes
FISHERIES BRANCH

J.R. Harper
DOBROCKY SEATECH LTD.
SIDNEY, B.C.

Victoria, B.C.
October 1984

**Canadian Cataloguing in Publication Data**

Howes, D. E. (Don Edwin), 1948-
Summary report: physical shore-zone analysis of Saanich Peninsula

(MOE technical report, ISSN 0821-0942 ; 9)

Bibliography: p.
ISBN 0-7718-8433-8

1. Shore-lines - British Columbia - Saanich Peninsula. 2. Coastal zone management - British Columbia - Saanich Peninsula. I. Harper, J. R. (John Reed) 1951- . II. British Columbia. Ministry of Environment. III. Title. IV. Title: Physical shore-zone analysis of Saanich Peninsula.

GB458.75.H68 1984 551.4'58'0971134 C84-092168-3

**© Copyright 1984. B.C. Ministry of Environment**
**First Printing 1984.**

## TABLE OF CONTENTS


| | Page |
|---|---|
| Introduction | 1 |
| Physical Shore-zone Classification | 1 |
| Data Sources and Procedure | 3 |
| Geological Setting | 3 |
| Marine Processes | |
| Waves | 5 |
| Wave Energy | 7 |
| Tides | 8 |
| Shore Types | 10 |
| Description of Shore Types | 11 |
| Distribution of Shore Types | 15 |
| Summary | 17 |
| References | 19 |
| Appendix (Shore Unit Description Table) | 21 |
| Physical Shore-zone Map | (in pocket) |


## ACKNOWLEDGEMENTS

The authors would like to thank C.P. Lewis, Ministry of Environment for reviewing the manuscript and E. Owens, Woodward-Clyde Consultants, who supplied the photographs, and who contributed significantly to the classification system used in this study.

## INTRODUCTION

This physical shore-zone analysis of Saanich Peninsula includes a 1:25 000 shore-zone map (back pocket) and this report. The report reviews: (1) the classification system used for mapping the shore-zone; (2) data collection methods; (3) the geological setting of the study area; (4) marine processes; and (5) the distribution and physical character of various shore types. In addition, the physical character of each shore unit identified on the map is described in detail in the Appendix. The information contained on the map and in the report provide a necessary data base for coastal zone planning and land management.

## PHYSICAL SHORE-ZONE CLASSIFICATION

The shore-zone of Saanich Peninsula has been classified and mapped according to a physical shore-zone classification system developed by Woodward-Clyde Consultants and the B.C. Ministry of Environment (Owens, Howes, and Lewis, in draft). The shore-zone is defined as the area extending seaward from the top of the coastal cliff or the landward limit of marine processes to the -20 metre isobath. This area is subdivided into continuous alongshore units made up of components that are homogeneous across and alongshore with respect to form (morphology), character of material, and geomorphic process (refer to Fig. 1). Thus, a shore unit is an association of components that are continuous across and alongshore in the shore-zone. For this study, the components of each shore unit have been stratified according to 4 tidal zones: backshore, intertidal, shallow and deep subtidal (for definition of these zones refer to the Appendix; p. 22).

Components form the basic building blocks used to describe the character of the shore-zone in this classification. Component descriptors that detail the physical attributes (form, material, etc.) of the shore-zone have been identified and defined. As well as this, standardized codes for each descriptor have been developed to simplify data recording on standard coding forms in the field and to facilitate computer compatibility. This basic structure and coding format insures that a detailed and standard data base is collected. This allows coastal geologists, biologists, planners and other users to make a number of interpretations for various environmental and land use concerns. (Note: The coding system is not described in this report as the description of each unit has been verbalized in the appendix.)

Shore units that repeat themselves along a segment of the shore-zone (e.g. alternating rock headlands and gravel pocket beaches) may be mapped as a composite shore unit. Composite units are made up of a primary and up to two subordinate subunits. The primary subunit accounts for >50% of the composite unit length, whereas the subordinate subunit or subunits account, in total, for <50% of the composite unit length.

A significant shore-zone feature that accounts for less than 10% of the unit length may be mapped as a variant. The location of a variant within a shore unit is indicated by the on-site symbol, V, on the map.

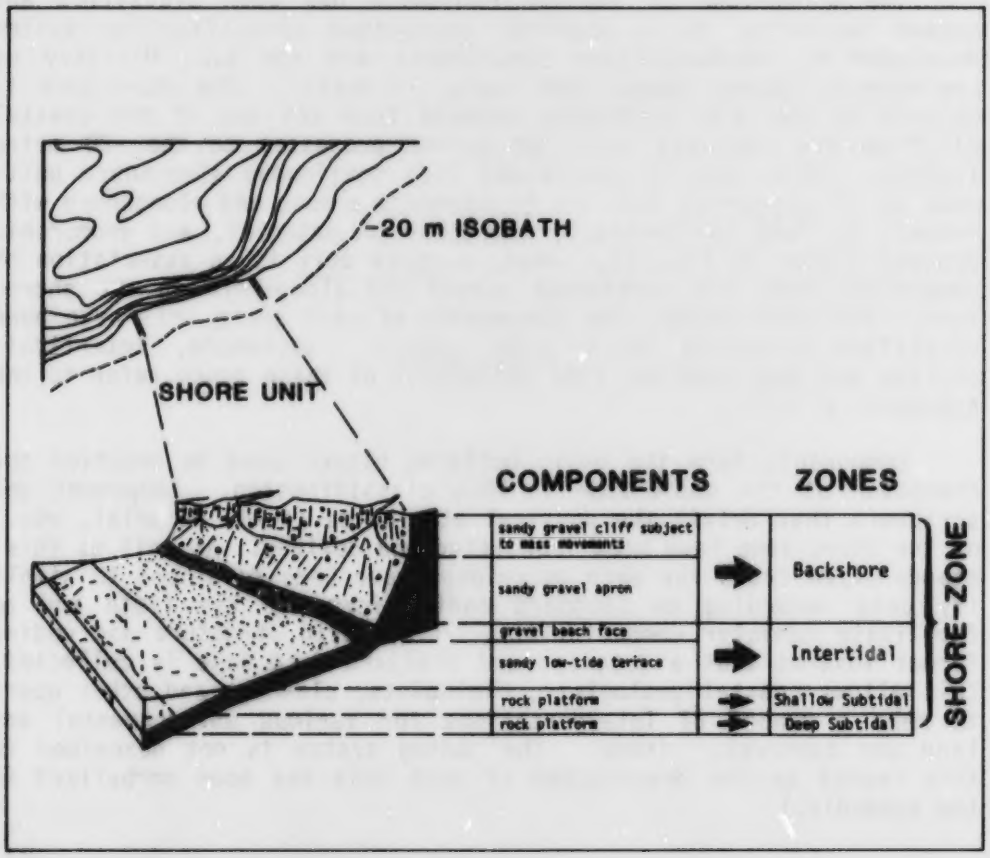



Figure 1 Example of a Shore Unit

## DATA SOURCES AND PROCEDURE

Information on the physical character of the Saanich Peninsula shore-zone was obtained from four sources: (1) 1:15 000 black and white, B.C. vertical photography flown in May 1964; (2) oblique 3/4 inch colour aerial videotape imagery taped by D. Howes and E. Owens at low spring tide in 1979; (3) field inspection conducted in the spring and fall of 1979; and (4) Canadian Hydrographic Chart 3451-Discovery Island to Saltspring Island.

The photographic and video imagery were used to: (1) subdivide the shore-zone into shore units; (2) distinguish shore unit morphologies (forms) such as cliffs, beaches, etc.; and (3) identify intertidal sediment types. Unit boundaries were recorded on the vertical air photographs. Data such as form and texture, as well as zonal widths obtained from the hydrographic chart were recorded on coding sheets for each unit using the standardized format.

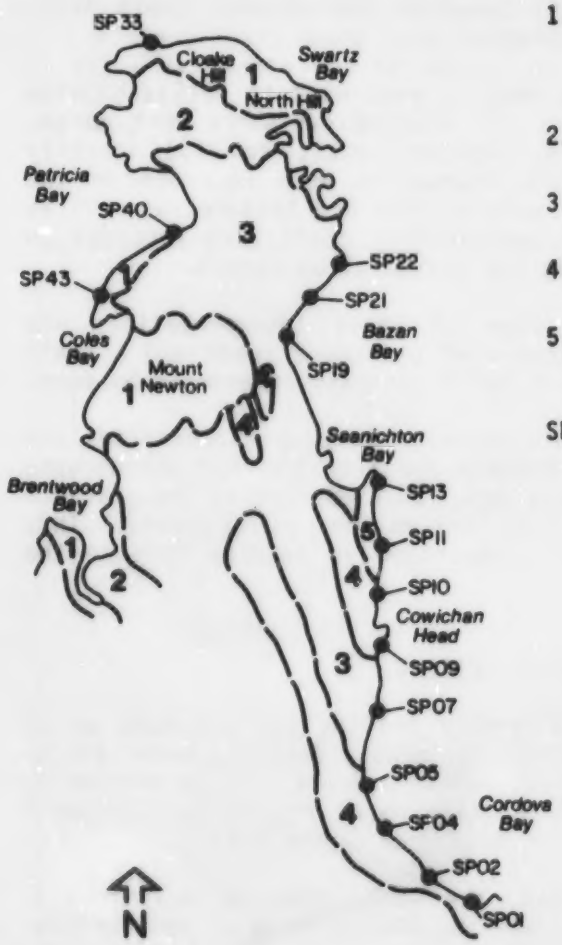
Field access for verification of these interpretations was provided by a well-developed network of backshore roads and a small inflatable boat. Each unit was at least partially traversed by foot.

With completion of the field survey, shore unit boundaries and the location of variants were transferred from the air photographs onto the 1:25 000 planimetric base map. Data describing the physical nature of each shore unit was finalized on the coding sheets. This data has been verbalized and is summarized in tabular form in the Appendix.

## GEOLOGICAL SETTING

The Saanich Peninsula is a gently rolling lowland made up of thick (in places greater than 50 m) Quaternary deposits underlain by sedimentary and intrusive (granitic rocks) bedrock. Hills mantled by a thin drift-cover and underlain by these rocks project locally above the lowland at Mount Newton, North Hill, and Cloake Hill.

During the Quaternary Period, the study area was subjected to multiple glaciations (Howes and Nasmith, 1983). Most of the surficial materials of the peninsula, however, were deposited during the Fraser Glaciation, the last major glaciation. Although this glaciation extended from 29 000 to 10 000 years ago, ice did not advance over the peninsula until sometime after 17 000 years ago. At this time glacial till was deposited and in some places, the ice eroded earlier Pleistocene deposits to form elongate ridges referred to as drumlins.




1. Moderate to steeply sloping bedrock in part overlaid by till and/or colluvium; includes Mount Newton, Cloake Hill
2. Rolling glaciomarine silts, in part overlaying rock
3. Thick, gently undulating glaciomarine silts usually overlying till
4. Drumlins, made up of till overlying thick deposits of silt, gravel, and sand
5. Postglacial marine deposits; silts and sand

SP02 Shore station sites for wave energy model (Figure 3 and Table 1)

Figure 2 Generalized Terrain of Saanich Peninsula

Deglaciation commenced about 14 000 years ago. During deglaciation and immediately following the disappearance of the ice, the sea flooded the isostatically depressed lowlands. The maximum height of marine inundation was 75 m. Below this elevation, glaciomarine silts and sands were deposited.

In postglacial time between 9250 and 5000 years ago, sea levels fell to -4 m below present sea level. During the last 5000 years the sea has risen slowly to its present position. Mass wasting processes, active during postglacial time, have resulted in the formation of colluvial mantles, usually on steep slopes.

A variety of surficial materials are found in the area as a result of this varied geologic history. Their distribution is outlined in Figure 2. Most of the eastern shore-zone of the peninsula is backed by thick deposits of glaciomarine silts (raised marine plain) or sediment-cored drumlins, some breached by the sea. In contrast to this, the north and west shore-zone of the study area is backed by moderately to steeply sloping bedrock controlled terrain. Sediments here usually occur as a thin mantle over the bedrock and include till or colluvium. Local variation to this pattern occurs at Patricia and Coles Bays. Here, the backshore is made up of thick glaciomarine silts, part of the raised marine plain.

## MARINE PROCESSES

Marine processes operating in the offshore areas of the Saanich Peninsula are important in controlling distribution and stability of shore types. The most important physical oceanographic processes affecting the study area are waves and tides.

### Waves

Waves are the most significant process affecting the shore-zone. High proportions of mechanical energy are expended at the shoreline as waves break. The mechanical wave action can erode sediment from the backshore, and remove sediment in either the alongshore or on-offshore directions. At some coastal locations, waves may cause a net onshore transport of material as well.

Waves reaching the shore-zone of the study area are locally generated waves: that is, waves generated in the immediate offshore areas and not propagated from other areas, such as the open Pacific Ocean. Wave heights are generally <2 m because fetch distances over which the waves are generated are usually less than 30 km. Consequently, annual wave energy levels are low in comparison to areas of Georgia Strait, Juan de Fuca Strait or the Pacific Ocean.

A wave climate model was developed to simulate wave exposure conditions around the Saanich Peninsula (Harper, 1982). Wave statistics computed for several stations (for location refer to Fig. 2) are summarized in Table 1. Additional shore-zone wave energy parameters for selected stations are illustrated in Figure 3 and include total wave energy levels, characteristic winter and summer wave energy levels and the alongshore component of wave energy. These parameters provide insight into the seasonal variability and rates of sediment transport in the Saanich Peninsula vicinity.

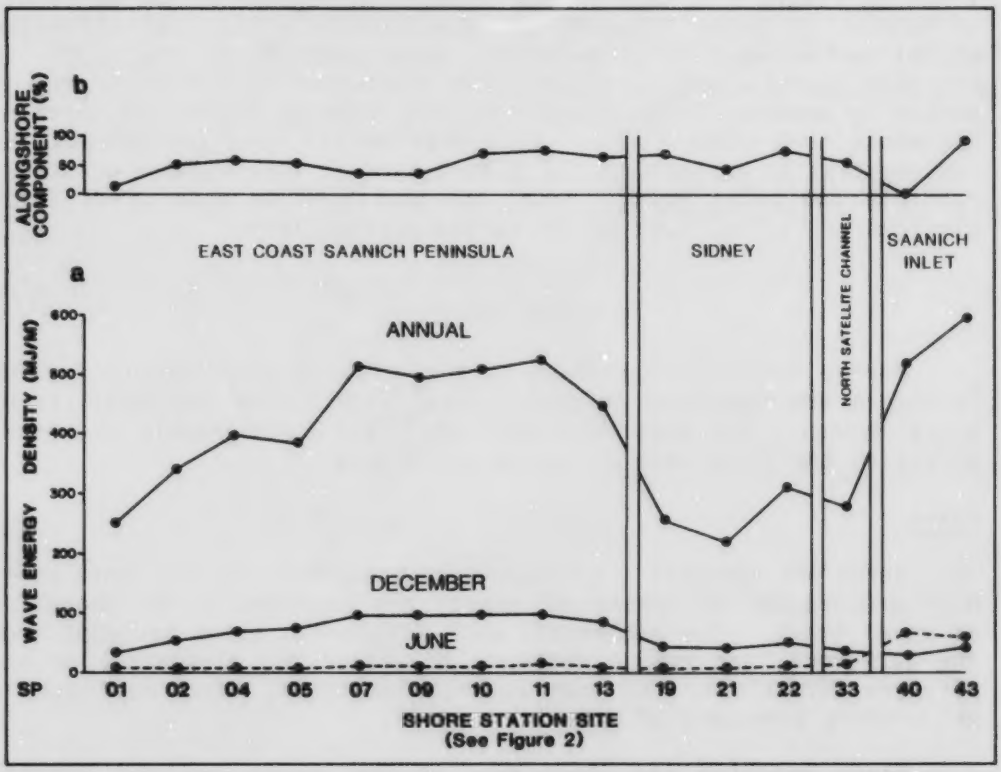



Figure 3 Deep water wave energy characteristics for various locations along the Saanich Peninsula. (a) Annual and seasonal (monthly) wave energy levels; (b) Alongshore component of annual wave energy levels.

## Wave Energy

Annual deep water wave energy levels indicate the estimated total energy expended in the shore-zone during the year. Areas of highest wave exposure are those with the longest fetch, located along the east coast of the study area. Coastal segments in the Sidney area and on the Satellite Channel shore have energy levels approximately 1/2 of the east coast sites. Areas along the west coast are exposed to strong westerlies and have comparatively high exposure levels, despite relatively short fetches (Table 1). Wave energy levels for the western coast, however, are probably over-estimated to some extent because Gonzales Heights wind data was used in the computer model.

Comparison of the December and June energy levels provides an index of the seasonal variability of shore processes (Fig. 3a, Table 1). In general, the comparison indicates that wave exposure levels (and hence sediment transport processes) are nearly an order of magnitude higher during the winter months than during the summer months. A notable exception is the Saanich Inlet coast which is protected from the winter southeasterlies and exposed to summer westerlies.

The alongshore deep water wave energy component, expressed as a percentage of the total wave energy, provides an index of the strength of long-shore transport (Fig. 3b). Beaches with a high proportion of alongshore wave energy show a strong longshore drift component such as near Island View Beach (stations SP-10 to SP-13, Fig. 3); on the other hand, Patricia Bay (SP-40) is dominated by waves approaching from directly offshore, and therefore has little alongshore transport along the coast. Longshore transport arrows on the map indicate dominant directions of longshore transport, although it should be emphasized that drift reversals may occur at any time throughout the year.

Analysis of the wave climate data are useful for examining potential offshore sediment transport in that waves often supply the energy to suspended bottom sediments, which can then be transported by even comparatively weak tidal currents. Maximum water depths for sediment disturbance (for sand size material) are computed for each station and listed in Table 1. More detailed analyses of the wave data, however, show that the area of wave dominated currents is much shallower. The areas of wave dominance, taken as the zone where wave suspension occurs for 1% of the time or more, are listed in Table 1 for each site. The zone of wave dominance is comparatively shallow for most of the Peninsula, but does include depths up to 12 metres off the eastern shore.

Table 1 Wave Climate Model

| Shore Station[2] | Fetch Characteristics[1] (Effective) | | | Wave Energy (MJ/m) | | | Dominant Longshore Transport Direction | Maximum Depth of Sediment Disturbance (m) | Zone of Wave-dominated Water Depths (m) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Total | Monthly Average | | | | |
| | Mean (km) | Maximum (km) | Direction of Maximum Fetch | Annual (Jan-Dec) | Winter (Nov-Jan) | Summer (June Aug) | | | |
| SP-01 | 6.0 | 9.5 | 000° | 250 | 36 | 4.4 | E | 12.3 | <6 |
| SP-02 | 7.6 | 11.7 | 045° | 340 | 52 | 5.9 | NE | 13.2 | <7 |
| SP-04 | 7.4 | 13.3 | 067° | 395 | 63 | 6.3 | N | 12.2 | <6 |
| SP-05 | 10.4 | 15.8 | 112° | 380 | 63 | 5.8 | N | 17.5 | <9 |
| SP-07 | 12.0 | 22.7 | 135° | 510 | 82 | 11.8 | N | 21.7 | <11 |
| SP-09 | 13.2 | 24.1 | 112° | 495 | 80 | 9.6 | N | 22.5 | <12 |
| SP-10 | 12.1 | 22.2 | 135° | 505 | 82 | 9.6 | N | 21.4 | <11 |
| SP-11 | 10.2 | 24.5 | 135° | 520 | 82 | 13.0 | N | 22.7 | <12 |
| SP-13 | 9.6 | 21.3 | 135° | 445 | 71 | 9.4 | N | 20.9 | <11 |
| SP-19 | 3.6 | 5.3 | 45° | 250 | 40 | 4.4 | Bi-directional | 7.6 | <4 |
| SP-21 | 3.9 | 5.2 | 67° | 210 | 35 | 3.7 | Bi-directional | 7.8 | <4 |
| SP-22 | 3.7 | 5.3 | 135° | 305 | 44 | 11.0 | None | 8.6 | <4 |
| SP-33 | 4.0 | 5.2 | 270° | 275 | 33 | 11.0 | None | 8.1 | <4 |
| SP-40 | 2.8 | 4.8 | 247° | 510 | 31 | 59.0 | None | 8.1 | <4 |
| SP-43 | 4.5 | 6.6 | 315° | 590 | 46 | 54.0 | N | 7.6 | <4 |

[1] C.E.R.C., 1977

[2] Location on Figure 2

## Tides

Tides are important in the dispersal of coastal sediments in two aspects:

(1) tides distribute wave energy over a vertical zone as as a result of the normal rise and fall of the tides,
(2) tidal currents contribute to sediment dispersal in the offshore.

Tidal ranges are listed for three selected sites in Table 2.

Table 2. Tidal Characteristics in the Saanich Peninsula Area (Canadian Hydrographic Service, 1984 Tide and Current Tables)

| | Mean Tidal Range (m) | Large Tidal Range (m) |
|---|---|---|
| Saanichton Bay | 2.29 | 3.69 |
| Swartz Bay | 2.38 | 3.81 |
| Brentwood Bay | 2.44 | 3.81 |

For locations refer to Figure 2.

Tides are particularly important in influencing coastal erosion events. Most severe events occur during periods of spring highwater during the winter when wave energy levels are high (due to south-easterly storms). During these events, wave action is concentrated directly at the base of unconsolidated cliffs and erosion is rapid (Thurber Consultants, 1973).

Tidal currents, illustrated in Figure 4, are probably the dominant process redistributing finer material in the offshore. Tidal currents are generally weaker along the western side of the Peninsula, in Saanich Inlet, than along the eastern side of the Peninsula where narrow constricted passages between the offshore island and the coast and where flow to and from the Strait of Georgia cause accelerated tidal currents (Figure 4). The difference in tidal flows is partially responsible for the coarser nature of the seabed to the east of the peninsula and the finer nature of the seabed to the west of the Peninsula.

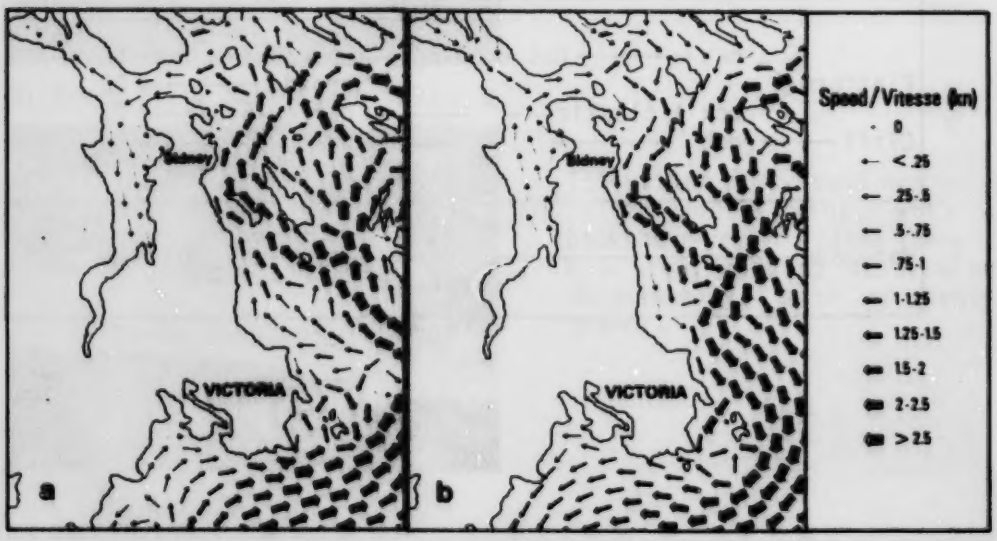



Figure 4. Tidal current patterns in the Saanich Peninsula area for spring tides; (a) mid-flood tide and (b) mid-ebb tide. (Source: Canadian Hydrographic Service, 1983)

## SHORE TYPES

In order to present the detailed shore unit data in a manner more easily understood by other professionals and non-technical users, the 113 shore units defined in the survey have been grouped into 12 shore types. Initially, the shore units were grouped into three major categories dependent on their material character (clastic sediment, rock and man-made). Clastic sediment units were then divided according to their form (e.g. cliff) with further subdivisions based on texture, presence or absence of an eroding backshore cliff and intertidal width. Rock types were defined by their form (cliff or platform) with further subdivisions based on the presence or absence of beach sediments, and intertidal width (Table 2).

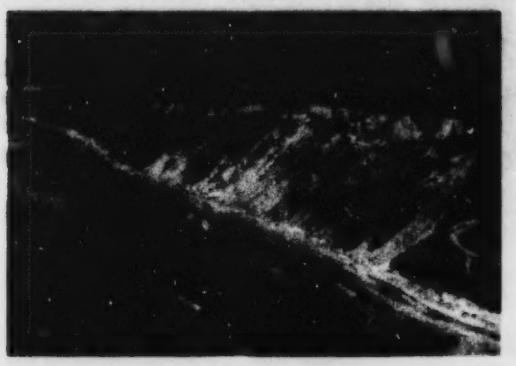
TABLE 2 Repetitive Shore Types

| | Form | Material/ Texture | Backshore Cliff | Intertidal Width | Repetitive Shore Type |
|---|---|---|---|---|---|
| SEDIMENT | Beach | sand | eroding | broad | B1 |
| | | | not eroding | broad | B2 |
| | | silty sand | " | broad | B3 |
| | | mixed | " | narrow-broad | B4 |
| | | rubble | " | narrow | B5 |
| | Mudflat | silt | " | broad | F |
| | Delta | sandy gravel | " | broad | D |
| ROCK | Platform | rock | not eroding | narrow | P1 |
| | | | | broad | P2 |
| | | rock + clastic | " | narrow-broad | P3 |
| | Cliff | rock | " | narrow | C |
| MAN | Man-made | | | | M |

## Description of Shore Types

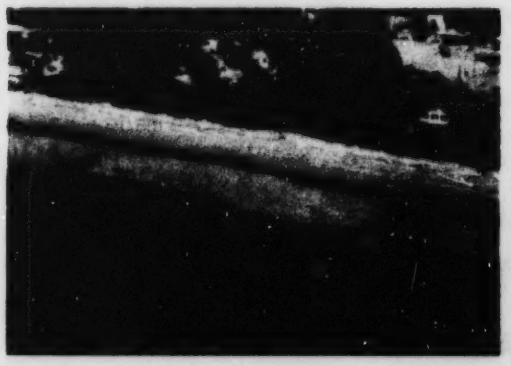
### Clastic Sediment Shore Types

1. Broad Sandy Beach - Eroding Backshore Cliff (B1)



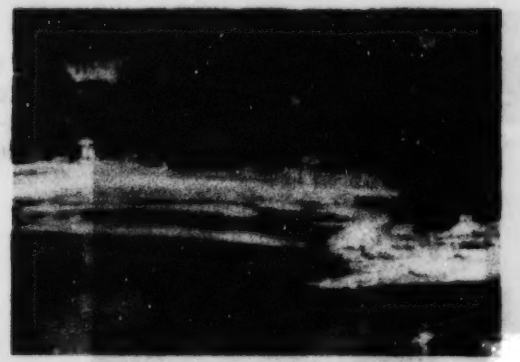
Intertidal sandy beach, 80 to 260 m wide, with a backshore cliff, >10 m high, made up of interbedded unconsolidated materials (silt, sand, gravel, till) undergoing modification by mass movements (slumps, slides).

2. Broad Sandy Beach (B2)



Intertidal sandy beach, 60 to 400 m wide, with a backshore cliff or occasionally a beach berm; the cliff is usually made up of silt, of variable height (1 - 20 m) and at a few sites, is being undercut by waves.

3. Broad Silty Sand Beach (B3)



Intertidal silty sand beach, 75 to 340 m wide, with a backshore cliff, less than 5 m high, made up of silt or occasionally, sand or sandy gravel.

4. Narrow to Broad Mixed Beach (B4)

Intertidal sandy gravel to gravel beach, 15 to 80 m wide, with a backshore cliff or infrequently, a beach berm; the cliff is usually <5 m high, made up of silt or till, or both.

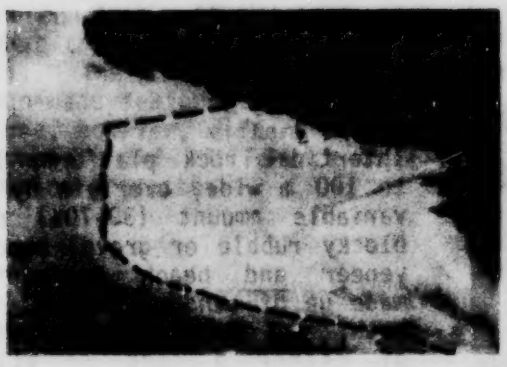
5. Narrow Rubble Beach (B5)

Intertidal blocky rubble beach, 3 to 15 m wide, with a backshore cliff made up of rock, sometimes with talus materials, 5 to >20 m high.

6. Broad Mudflat (F)

Intertidal silty sand or silt flat (slopes <5°), 150 to 700 m wide, with a low backshore cliff, <5 m high, made up of silt.

7. Broad Delta (D)



Intertidal delta, 80 to 240 m wide, made up of sandy pebble gravel and occasionally, cobble pebble gravel with a backshore cliff, 1 to 5 m high, made up of silt.

ROCK SHORE TYPES

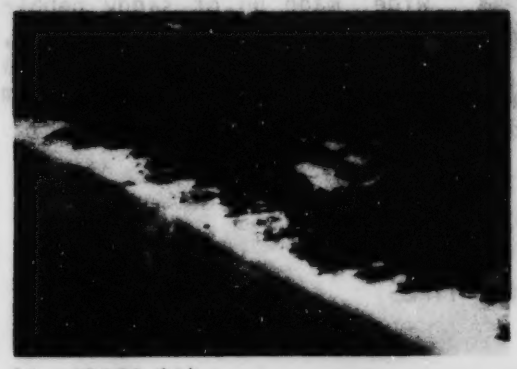
8. Broad Rock Platform with Beach Veneer (P1)

Intertidal rock platform, 60 to 100 m wide, overlain by a variable amount (30-70%) of bouldery cobble or blocky beach veneer (<1 m thick); the backshore usually consists of a rock cliff, 1 to 5 m high.

9. Narrow Rock Platform with Beach Veneer (P2)

Intertidal rock platform, 5 to 60 m wide, overlain by a variable amount (30-70%) of blocky rubble or gravel beach veneer (<1 m thick); the backshore usually consists of a rock cliff, occasionally overlain by till or silt, and is up to 20 m high.

10. Rock Platform and Beach Sediments

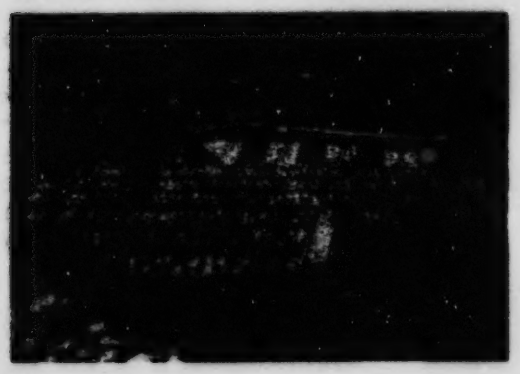


Intertidal rock platform, 10 to 100 m wide, overlain by a variable amount (30-70%) of blocky rubble or gravel beach veneer and beach sediments made up of sand or gravel, or both; the backshore consists of either a rock or silt cliff, 1 to 10 m high.

11. Cliff (C)

Intertidal rock cliff, <2 m high; the backshore consists of a rock cliff, 5 to 20 m high.

12. Man-Made or Man-modified (M)



Man-modified units; includes marinas, wharfs, seawalls, boat ramps and ferry terminals.

## Distribution of Shore Types

In general, the shore-zone of the Saanich Peninsula consists of an equal mix of beaches and rock landforms (platforms and cliffs) that together account for about 87% of the total shore length (Table 3). The remaining shore-zone is made of mudflats, deltas, and man-made features. The physical character of the east coast shore-zone, however, differs significantly from that of the north and west coasts. This difference is a function of sediment availability and marine processes.

TABLE 3 Distribution of Shore Types

| SHORE TYPE[1] | EAST COAST km | EAST COAST % | NORTH AND WEST COAST km | NORTH AND WEST COAST % | TOTAL km | TOTAL % |
|---|---|---|---|---|---|---|
| sand beaches (B1,B2,B3) | 18.27 | 48.9 | 4.57 | 11.4 | 22.84 | 29.5 |
| mixed, rubble beaches (B4,B5) | 4.67 | 12.6 | 6.23 | 15.6 | 10.9 | 14.1 |
| mudflats (F) | 3.86 | 10.4 | .25 | .6 | 4.11 | 5.11 |
| deltas (D) | 1.39 | 3.7 | 1.95 | 4.9 | 3.34 | 4.3 |
| rock platforms (P1,P2,P3) | 6.64 | 17.7 | 23.78 | 59.5 | 30.42 | 39.4 |
| rock cliffs (C) | .79 | 2.1 | 1.89 | 4.7 | 2.68 | 3.5 |
| man (M) | 1.75 | 4.6 | 1.30 | 3.3 | 3.05 | 3.9 |
| TOTAL | 37.37 | 100 | 39.97 | 100 | 77.34 | 100 |

[1] Note: some types have been grouped together for comparison purposes.

The shore-zone of the east coast is dominated by clastic sediment types, particularly, broad sand beaches. Beaches dominate the coastal landforms on this coast because there is an abundant supply of sediment from the backshore and high annual wave energy levels (Fig. 3a). Thick, unconsolidated sediments in the backshore (Fig. 2), particularly, sediment-cored drumlins breached by the sea at Cordova Bay and Cowichan Head, act as excellent sediment sources. Rates of coastal erosion (cliff retreat) of .3 to .6 m/year (Thurber Consultants, 1973; and Foster, 1976) at these sites provide a relative indication of the potential sediment available. Long-shore transport of beach materials on this coast is predominately in a northerly direction (refer to map in pocket).

An exception to this shore-zone landform pattern occurs along the northern part of the east coast where the shore-zone is made up of mudflats (Tsehum Harbour-a sheltered bay) and beaches with some rock platforms (near Sidney-refer to map in pocket). This portion of the coast has low annual wave energy levels (Fig. 3a) and a variable supply of available sediment in the backshore. The character of the backshore varies from thick unconsolidated materials (e.g. Bazan Bay) to rock cliffs or shallow sediments overlying rock (e.g. north of Sidney).

In contrast to the east coast of Saanich Peninsula, the north and west coasts have shore-zones dominated by rock landforms. The most common type is a narrow intertidal platform that is overlain by a variable amount of thin beach sediments (< 1 m thick). Although the annual wave energy levels differ significantly for these two coasts (Fig. 3a), both coasts are backed by thin, drift-covered bedrock controlled terrain with local pockets of thicker unconsolidated materials (Fig. 2). The backshore of these coasts is typically a rock cliff, sometimes overlain by sediment. The cliff appears to be stable (i.e. imperceptible rate of erosion) at most sites. Hence, both shore-zones (north and west) suffer from a lack of available sediment in the backshore. Beaches on these coasts usually occur as a small pocket beach that is coarser and narrower than those of the east coast. Broad sandy beaches are located at Deep Cove and Patricia Bay. These occur as a result of moderately high annual wave energy levels on the west coast (Fig. 3a) and the fact that locally the backshore is made up of thick unconsolidated sediments (Fig. 2) which serve as a local source for beach sediments. A similar situation exists for the smaller pocket beaches; they also have backshore cliffs of unconsolidated materials that provide a local beach sediment source.

## SUMMARY

1. The physical character of the shore-zone of the Saanich Peninsula varies primarily according to available sediment sources and secondarily, to annual wave energy. The east and west coasts have similar annual wave energy levels. The eastern shore-zone, however, is backed by thick unconsolidated sediments (eroding at a rate of .3 to .6 m/year at some sites) whereas the west coast has a bedrock controlled backshore that is relatively stable and provides little sediment for beach construction. Thus, the west coast is sediment starved and rocky, and the east coast is sediment rich and made up of beaches. In contrast, the shore-zone of the north coast and around Tsehum Harbour have the lowest annual wave energy levels. The former area is backed by rock cliffs with intertidal rock platforms while the latter consists of mudflats, sand beaches and some rock platforms with a backshore made up of thick, unconsolidated materials and rock. The difference in coastal landforms of these two coasts can be attributed to the variation of available sediment in the backshore.

2. Wave exposure levels (and hence sediment transport processes) are nearly an order of magnitude higher during the winter months than during the summer months. The west coast of Saanich Inlet which is protected from the winter southeasterlies and exposed to summer westerlies is a notable exception.

3. Tides are important in influencing coastal erosion during periods of spring highwater in the winter when wave energy levels are high due to southeasterly storms. Spatial variations in tidal currents offshore are partially responsible for finer sediments in Saanich Inlet compared to those offshore areas east of the Penninsula.

## REFERENCES

Canadian Hydrographic Service, 1983. Current Atlas, Juan de Fuca Strait to Strait of Georgia, Dept. of Fisheries and Oceans, Institute of Ocean Sciences, Sidney, B.C.

Clague, J.J., Harper, J.R. Hebda, R.J., and Howes, D.E. 1981. Late Quaternary sea levels and crustal movements, coastal British Columbia; Canadian Journal of Earth Sciences, V. 19, No. 3, pp. 597-618.

Coastal Engineering Research Center (CERC), 1977. Shore Protection Manual. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvair, Virginia, 3 Vols.

Foster, H.D. 1976. Coastal erosion: a natural hazard of the Saanich Peninsula, Vancouver Island; in Victoria: Physical Environment and Development, ed. H.D. Foster; Univ. of Victoria, Western Geographic Series, V. 12, pp. 131-184.

Harper, J.R. 1982. Geological Application of a wave climate model - southern British Columbia, Abstract in Coastal Erosion and Sedimentation Workshop, Vancouver, B.C., Sponsored by the Assoc. Committee on Research, Coastal Erosion and Sedimentation.

Howes, D.E. and Nasmith, H.W. 1983. Quaternary geology of southern Vancouver Island, Field Trip Guidebook II; Geological Association of Canada, Mineralogical Association of Canada, Canadian Geophysical Union.

Muller, J.E. 1977. Geology of Vancouver Island; Geological Survey of Canada. Open File 463.

Owens, E.H. 1979. Physical shore-zone analysis of North Saanich; by Woodward-Clyde Consultants for Capital Regional District, Victoria, B.C.

Owens, E.H. 1980. Physical Shore-zone analysis, Saltspring Island, B.C., Woodward-Clyde Consultants for Lands Directorate Pacific and Yukon Region, Environment Canada, Vancouver, B.C.

Owens, E.A., Howes, D.E. and Lewis, C.P. (in draft). Physical Shore-Zone Classification; Ministry of Environment, British Columbia Government.

Stanley-Jones, C.V. and Benson, W.A. (editors). 1973. An inventory of land resources and resource potential in the capital regional district, British Columbia Land Inventory-Canadian Forest Service and Canada Department of Agriculture.

Thurber Consultants. 1973. Shoreline Stability, North Gordon Head pre-design sewer study.

# APPENDIX

## Shore Unit Description Table

# Explanatory Notes and Definitions for Shore Unit Table

1. Unit # - length refers to shore unit number on the map and the length of that unit in km.

2. For a complete description of a shore type refer to the Shore Type Description; note where a unit is made up of two or more shore types the length of each type is indicated in brackets below the shore type symbol.

3. Unit Type Codes

| | |
|---|---|
| P..... | primary subunit; accounts for >50% of unit length |
| S,$S_1$... | secondary subunit; accounts for <50% of unit length |
| V,$V_1$... | variant(s), minor shoreline feature(s); accounts for <10% of unit length |

4. Definition of Zones

| | |
|---|---|
| Backshore: | the zone that extends landward from the higher high water line for large (spring) tide; the inland boundary is variable and is usually the top of the coastal cliff or landward limit of marine processes. |
| Intertidal | the zone between higher high water line and lower low water line for large (spring) tide. |
| Shallow subtidal | the zone that extends seaward from the lower low water line for large (spring) tide to the -10 m isobath. |
| Deep subtital: | the zone that lies between the -10 m and -20 m isobath |

5. Definition of Clastic Textural Terms

Texture refers to the size, roundness and sorting of particles in clastic sediments.

| Name | Size (mm) | Other Characteristics |
|---|---|---|
| clay | <.002 | - |
| silt | .002 - .06 | - |
| mud | <.06 | mixture of silt and clay |
| sand | .06 - 2 | - |
| pebble | 2 - 64 | rounded and subrounded particles |
| cobble | 64 - 256 | " |
| boulder | >256 | " |
| gravel | >2 | mixture of pebble, cobble, and possibly boulders with some sand |
| rubble | 2 - 256 | angular and subangular particle |
| block | >256 | " |

Notes

1. Where two or more textural terms are used together they are written in order of increasing importance. For example, a sandy pebble beach indicates that the beach is made up of pebbles with a minor amount of sand.
2. The term "till" refers to material deposited by glaciers that is well-compacted and consists of a mixture of particle sizes in a matrix of sand, silt, and clay.

6. Definition of Forms

| | |
|---|---|
| Beach: | An accumulation of unconsolidated material formed by waves and extends from lower low water line for large (spring) tide to a place where there is a marked change in material or form, usually the effective limit of storm waves. |
| Beach berm: | A low, nearly horizontal bench formed by material thrown up and deposited by storm waves. |
| Beach face: | The sloping section of the beach, below the berm exposed to the action of wave uprush. |
| Beach low-tide terrace: | A flat or gently sloping (<5°) surface extending from the lower low water line for large (spring) tide to the break in slope marked by the beach face. |
| Beach ridge: | A ridge or ridges that is (are) usually parallel to the shoreline and is (are) built-up by waves and currents. |
| Beach veneer: | Beach sediments (<1 m thick) that take on the form of the surface of the underlying material which is usually bedrock. |
| Cliff: | A sloping face that is steeper than 20° formed by erosional processes. |
| Delta: | An accumulation of sand, silt, and gravel deposited at the mouth of a stream where it discharges into the sea. |
| Tidal flat: | A level or gently sloping surface (<5°) exposed at low tide consisting of sand or mud and formed by tidal processes. |
| Lagoon: | A shallow stretch of water lying parallel to the shoreline separated from the open sea by a barrier and has free connection to the sea; includes lagoons that form at low tide. |
| Platform: | A level to inclined surface with a slope of 20° or less formed by erosion processes. |

7. Fetch Descriptors

| | |
|---|---|
| Unit orientation: | refers to the seaward direction the unit is facing; it is the direction perpendicular to the unit length. |
| Maximum fetch: | measured in kilometres from the centre point of the shore unit. |
| Fetch window: | refers to the degree of exposure (or shelter) of a shore unit; measured in degrees. |

| Unit #-Length | Shore Type | Unit Type | Backshore Description | Intertidal Description | Intertidal Width | Shallow Subtidal Description | Deep Subtidal Description | Fetch Descriptors: Unit Orientation | Max. Fetch | Fetch Window |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-2.76 | B1 | - | steep cliff, >10 m in height, made up of interbedded till, gravel, sand, and silt, and undergoing modification by mass movement (eroding) | sandy low-tide beach terrace with a pebble beach face adjacent to the backshore | 80-110 | sand grading to a muddy sand, width 300 to 450 m | muddy sand, width 400 to 1500 m | northeast | 22 | 140 |
| | | Y1 | as above | rock platform | - | - | - | | | |
| | | Y2 | as above | sandy pebble delta | - | - | - | | | |
| | | Y3 | modified portion of cliff by man-made sea wall | - | - | - | - | | | |
| 2-1.4 | B2 | - | a cliff made up on unconsolidated sediments (silt,till) overlying rock and rock, 5-20 m in height | sandy beach bar with a lagoon at low water and a gravel beach face adjacent to the backshore | 110-140 | sand grading to muddy sand; width 500 to 800 m | muddy sand; width 1500 m | northeast | 17 | 130 |
| 3-0.52 | B2 | - | a cliff, 5-20 m in height, made of rock and unconsolidated material over rock (silt, till) | sandy beach bar with a lagoon at low water and channel to open sea with a sandy gravel beach face and berm adjacent to the backshore | 130-210 | sand grading to a muddy sand; width 500 to 800 m | muddy sand; width 1100 to 1400 m | northeast | 16 | 130 |
| 4-1.09 | B2 | - | a cliff made up of silty sand, with a height of 5-10 m | sandy beach bar with a sandy cobbly pebble beach face and berm adjacent to the backshore | 80-110 | sand grading to a muddy sand; pocket of sandy gravel in central portion; width 900 to 1200 m | muddy sand; width 1000 to 1200 m | east | 54 | 120 |
| | | Y | - | sandy pebble delta | - | - | - | | | |
| 5-0.65 | B2 | P | a cliff, 1-10 m in height, made up of silt | sandy beach bar with a lagoon at low water and a sandy pebble beach face adjacent to the backshore | 120 | sand grading to a muddy sand; width 800 m | muddy sand; width 800 to 1000 m | east | 55 | 140 |
| | B2 | S | as above | sandy beach bar with a lagoon at low water and a rock platform adjacent to the backshore | 80 | sand grading to a muddy sand; width 800 m | muddy sand; width 800 to 1000 m | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6-1.5 | B2 (1.1) | P | a cliff, 5-10 m in height, made up of silt and undergoing minor modification by mass movements | sandy beach bar with a sandy pebble beach face and berm adjacent to the backshore | 80-95 | sand grading to a muddy sand; pocket of sandy gravel in northern portion; width 700 to 1000 m | muddy sand; width 500 to 700 m | east | 77 | 140 |
| | D (.4) | S | as above | sandy pebble to pebble cobble delta | 110-120 | as above | as above | | | |
| | | V1 | - | rock platform | - | - | - | | | |
| | | V2 | - | rock island | - | - | - | | | |
| 7-0.65 | P2 (.4) | P | cliff, 1-20 m in height, made up of silt overlying till | rock platform with <50% gravel beach veneer | 10-45 | sand grading to a muddy sand; width 800 to 900 m; subtidal bar adjacent to intertidal zone | muddy sand; width 400 to 500 m | northeast | 75 | 130 |
| | B4 (.25) | S | as above | sandy, cobble pebble beach face with a beach berm adjacent to the backshore | 40 | as above | as above | | | |
| 8-0.25 | B1 | - | cliff, 10-20 m in height, made up of silt overlying till and actively eroding (mass movements) | sandy low tide beach terrace with sandy gravel beach face adjacent to the backshore | 80 | sand grading to a muddy sand; width 900 m; subtidal bar adjacent to intertidal zone | muddy sand; width 300 to 400 m | east | 77 | 130 |
| 9-0.75 | B1 | - | cliff, >10 m in height, made up of interbedded till, silt, and sand, and undergoing modification by mass movements (eroding) | sandy low-tide beach terrace and beach veneer over unconsolidated silt with pebble sand beach face adjacent to the backshore | 100-110 | sand grading to a muddy sand; width 500 to 900 m | muddy sand; width 250 to 600 m | east | 77 | 140 |
| 10-0.5 | B2 | | raised beach deposit, occasionally subject to storm waves | sandy low-tide terrace with the odd boulder and sandy pebble beach face adjacent to the backshore | 100-130 | sand; width 400 m | muddy sand; width 500 to 600 m | east | 77 | 140 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 11-0.48 | B1 | - | cliff, >10 m in height, made up of interbedded silt, till, gravel and sand, and actively eroding (mass movement); colluvial cones extend along parts of the cliff base | sandy low-tide beach terrace and multiple bars with a sandy pebble beach face adjacent to the backshore | 260 | sand; width 400 to 600 m | muddy sand; width 200 to 500 m | east | 55 | 90 |
| 12-0.4 | B1 | - | as unit 11 above | sandy beach bar with a lagoon at low water and a sandy pebble beach face adjacent to the backshore | 260 | sand; width 500 m | muddy sand; width 200 m | east | 77 | 180 |
| 13-0.7 | B2 | - | man-made seawall | sandy low-tide terrace with some cobbles with a pebbly sand beach face adjacent to the backshore | 80 | subtidal sand bar; width 400 to 500 m | muddy sand; width 100 to 200 m | east | 77 | 170 |
| 14-0.31 | B2 | - | beach berm; subject to storm waves | sandy and pebbly sand beach bars with a sandy pebble beach face adjacent to the backshore | 160-180 | subtidal sand bar; width 300 m | sand; width 100 m | east | 77 | 170 |
| 15-0.87 | B2 | - | beach berm; subject to storm waves | sandy beach of multiple bars with a sandy gravel beach face adjacent to the backshore | 320-400 | sandy gravel; width 200 m | sandy gravel; width 50 to 100 m | east | 77 | 180 |
| 16-0.28 | B4 | - | beach berm; subject to storm waves | sandy pebble low-tide beach terrace with a sandy pebble beach face adjacent to the backshore | 45-60 | sandy gravel; width 200 m | sandy gravel; width 100 m | east | 77 | 180 |
| 17-0.94 | B2 | - | beach berm, subject to storm waves | sandy beach bar with a sandy pebble beach face adjacent to the backshore | 90-130 | sandy gravel; width 300 m | sandy gravel with minor muddy sand; width 100 m | east | 77 | 130 |
| 18-0.68 | B4 | P | beach berm; subject to storm waves | sandy pebble to pebble cobble beach face with a small low-tide beach terrace | 35-40 | muddy sand; width 50 to 100 m | muddy sand; width 50 to 100 m | north | 6 | 270 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | B4 | S | as above | sandy pebble to pebble cobble beach face | 30 | sandy gravel; width 50 to 100 m | sandy gravel; width 50 to 100 m | | | |
| 19-0.2 | B2 | - | beach berm; subject to storm waves | sandy low-tide beach terrace with a sandy pebble beach face adjacent to the backshore | 70-75 | mud; width 100 m | mud, some muddy sand; width 100 to 200 m | northwest | 9 | 76 |
| 20-0.2 | B2 | - | beach berm; subject to storm waves | sand to silty sand low-tide beach terrace and bars with sandy pebble beach face | 75-100 | mud; width 300 m | muddy sand; width 800 m | northwest | 9 | 76 |
| 21-0.14 | F | - | low cliff, <1 m in height, made up of sand and gravels | silty tidal flat with an ebb-tidal delta and sandy beach bar adjacent to the subtidal | 630 | mud; width 300 m | muddy sand; width 800 m | northwest | 9 | 76 |
| 22-0.97 | B3 | - | cliff, 1-5 m in height, made up of silt | silty sand low-tide terrace with bars with a sandy pebble beach face adjacent to the backshore | 180-200 | mud with muddy sand; width 400 m | muddy sand; width 400 m | north | 9 | 70 |
| 23-0.5 | D (.3) | P | cliff, 1-5 m in height, made up of silt | sandy pebble delta | 250 | muddy sand; width 500 m | muddy sand, width 400 m | | | |
| | B2 (.2) | S | as above | sandy low-tide beach terrace with a sandy pebble beach face adjacent to the backshore | 110 | muddy sand; width 500 m | muddy sand; width 500 m | east | 3 | 70 |
| | | V | - | rock platform with some sandy pebble beach veneer over rock | - | - | - | | | |
| 24-0.4 | C (.25) | P | rock (igneous) cliff, 1 to 5 m in height | rock cliff with minor blocky, rubble beach sediments | <5 | muddy sand; width 100 m | muddy sand; width 600 m | | | |
| | P2 (.15) | - | as above | horizontal rock platform (igneous rock) | 25 | muddy sand; width 150 m | muddy sand; width 500 m | east | 8 | 120 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 25-0.29 | B2 | - | cliff, 5 to 10 m in height, made up of silt | sandy low-tide beach terrace and bar with a gravel beach face adjacent to the backshore | 140 | muddy sand; width 300 m | muddy sand; width 300 m | northeast | 8 | 80 |
| | | V1 | - | rock platform with minor beach sediments | - | - | - | | | |
| | | V2 | - | sandy pebble delta | - | - | - | | | |
| | | V3 | sand overlying a rock cliff 1 to 5 m in height | - | - | - | - | | | |
| 26-0.9 | P2 | P | cliff, 1-10 m in height, made up of silt and silt overlying till | horizontal rock platform with <50% gravel (boulder, cobble, pebble) beach veneer | 25-50 | sandy gravel for first 100 m; muddy sand for 100 to 200 m; total width 200-300 m | muddy sand; width 100 to 200 m | east | 13 | 130 |
| | P2 | S | as above | rock platform with >50% gravel beach veneer | 25-50 | as above | as above | | | |
| 27-1.95 | P3 (1.2) | P | cliff, 1 to 5 m in height, made up of silty sand and/or silt | boulder, cobble beach veneer (<1 m thick) overlying rock platform with rock outcrops; sandy low-tide beach terrace adjacent to subtidal | 60-100 | sandy gravel for 200 to 300 m; muddy sand for next 100 m; total width 300-400 m | muddy sand; width 100 to 500 m | northeast | 12 | 170 |
| | P1 (.75) | S | as above | boulder, cobble beach veneer, (<1 m thick) overlying rock platform with some rock outcrops | 100 | as above | as above | | | |
| 28-1.1 | B1 | - | cliff, 1 to 10 m in height, made up of silt or sandy silt and in part, protected by a seawall and undergoing modification by gravity | sandy low-tide beach terrace with a sand bar adjacent to the subtidal and a gravel beach face adjacent to the backshore | 130-150 | sandy gravel for 500 m; muddy sand for next 200 m; total width 700 m | muddy sand; width 700 m | east | 11 | 130 |
| 29-0.16 | D | - | cliff, 1 to 5 m in height, made up of silt or sandy silt | sandy pebble delta with a sandy beach bar adjacent to the subtidal | 140 | as unit 28 | as unit 28 | southeast | 8 | 140 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 30-1.48 | B4 | - | cliff, 1 to 5 m in height, made up of silt | sandy pebble gravel low-tide beach terrace with scattered cobbles and a pebble beach face adjacent to the backshore | 40-100 | sandy gravel grading into a muddy sand; width 500 to 800 m | muddy sand; width 300 to 700 m | southeast | 10 | 140 |
| | | V1<br>V2 | wharf<br>- | -<br>rock platform | -<br>- | -<br>- | -<br>- | | | |
| 31-0.32 | P2 (.18) | P | cliff, 1 to 5 m high, made up of sandy silt and pebbles, with some bedrock outcrops | horizontal rock platform with minor blocky rubble beach veneer (< 1 m thick) over rock | 20-50 | width 500 m | width 100 to 300 m | east | 12 | 180 |
| | P3 (.14) | S | as above | horizontal rock platform covered by more than 50% by a gravel beach veneer with a boulder, cobble beach face adjacent to the backshore | 40-60 | width 500 m | width 100 to 300 m | | | |
| 32-0.3 | M | - | man-made seawall, wharf, jetty | rock platform covered by more than 50% by a gravel beach veneer | 15-50 | width 500 m | width 100 m | east | 12 | 140 |
| 33-1.35 | P1 (.75) | P | cliff, < 1 to 5 m in height, made of rock with some sediment overlying rock | rock platform with less than 50% covered by boulder, cobble, blocky beach veneer (<1 m thick) | 100 | width 200 to 500 m | width 100 to 150 m | east | 13 | 150 |
| | B2 (.6) | S | cliff, 1 to 5 m in height, made of silt partially modified by man-made seawall | cobble, pebble beach face and veneer over rock with sandy beach bars adjacent to the subtidal | 40-100 | as above | as above | | | |
| | | V1<br>V2 | -<br>marina | rock platform<br>- | -<br>- | -<br>- | -<br>- | | | |
| 34-0.08 | P2 | - | rock cliff, 1 to 5 m in height | rock platform; with a slope of 5-15° | 10-20 | - | - | north | 8 | 110 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 35-0.68 | B3 (.4) | P | cliff, <1 to 5 m in height made up of sandy silt | silty sand low-tide beach terrace with a sandy beach bar and a pebble beach face and veneer over rock adjacent to the backshore | 150-340 | width 800 m | width 300 m | north | 8 | 90 |
| | D (.28) | S | as above | sandy pebble delta with a silty sand low-tide beach terrace and sandy beach bar adjacent to the sub-tidal | 150-340 | as above | as above | | | |
| | | V | - | rock platform | - | - | - | | | |
| 36-0.69 | B3 (.49) | P | cliff, <1 to 5 m in height, made up of silty sand | silty sand low-tide beach terrace with a cobble pebble beach face adjacent to the backshore | 130-150 | width 800 m | width 100 m | east | 6 | 40 |
| | D (.2) | S | as above | sandy pebble delta grading to a silty sand low-tide beach terrace | 130-150 | as above | as above | | | |
| | | V1 | - | rock platform with >50% rubble beach veneer | - | - | - | | | |
| | | V2 | pebble beach | - | - | - | - | | | |
| 37-0.42 | P1 | - | rock cliff, 1 to 5 m in height | horizontal rock platform covered by >50% blocky, bouldery rubble beach veneer | 60 | width 800 m | width 100 m | southeast | 8 | 150 |
| | | V | cliff, 1 to 5 m in height, made up of silt | cobble pebble beach face | | - | - | | | |
| 38-0.53 | C (.43) | P | rock cliff (igneous rock), 1 to 10 m in height | rock cliff; minor rock platform | 3-5 | mud; 700 m to opposite shore | - | north | 8 | 60 |
| | B4 (.1) | S | cliff, made up of silty sand, 1 to 5 m high | cobble, pebble low-tide beach terrace with sandy pebble beach face adjacent to the backshore | 35 | as above | - | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 39-0.42 | N | - | marina and jetty | - | - | mud; 800 m to opposite shore | - | north | <1 | <45 |
| 40-0.52 | F | - | cliff, 1 to 5 m in height, made up of silt | silty sand tidal flat | 150-250 | mud; 900 m to opposite shore | - | north | <1 | <45 |
| | | V1 | wharf | - | - | - | - | | | |
| | | V2 | seawall for erosion protection | - | - | - | - | | | |
| | | V3 | seawall for erosion protection | - | - | - | - | | | |
| 41-1.02 | B2 (.6) | P | concrete seawall | sandy to pebbly sand beach low-tide terrace with a pebble beach face adjacent to the backshore | 75 | mud; 400 to 800 m to opposite shore | - | northeast | <1 | <45 |
| | P2 (.42) | S | rock cliff, 1-5 m | horizontal rock platform with <50% cobble, pebble beach veneer (<1 m thick) | 15-25 | as above | - | | | |
| | | V1 | - | pebble beach face | - | - | - | | | |
| | | V2 | marina | | - | - | - | | | |
| | | V3 | - | igneous rock platform | - | - | - | | | |
| 42-1.4 | F | - | cliff, 1 to 5 m in height, made up of silt | silty sand tidal flat | 300-400 | mud; 400 m to opposite shore | - | northeast | <1 | <45 |
| | | V1 | - | pebble sand beach face | - | - | - | | | |
| | | V2 | marina | - | - | - | - | | | |
| | | V3 | - | igneous rock platform | - | - | - | | | |
| | | V4 | concrete seawall | - | - | - | - | | | |
| | | V5 | sand beach | - | - | - | - | | | |
| 43-0.28 | B3 (.15) | P | cliff, 1 to 5 m in height, made up of shelly, sandy gravel | silty sand low-tide beach terrace with a sandy pebble beach face adjacent to the backshore | 75-100 | mud; width 1500 m | width 500 m | southeast | <1 | <45 |
| | P2 (.13) | S | cliff, 1 to 5 m in height, made up of silt | rock platform covered by <50% by a blocky, sandy, rubble beach veneer | 25-75 | mud; width 1500 m | width 600 m | | | |
| | | V | - | igneous rock platform | - | - | - | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 44-0.25 | M | - | marina | - | - | mud for 200 m to opposite shore | - | north | <1 | <45 |
| 45-1.8 | F | - | silt platform, 5-10° | silty sand tidal flat | 700 | mud for 200 m to opposite shore | - | north | <1 | <45 |
| 46.0.78 | M | - | marina | - | - | - | - | south | <1 | <45 |
| 47-0.11 | C | - | sedimentary rock cliff, 1 to 5 m in height | rock cliff | 2 | mud; 100 m to opposite shore | - | west | <1 | <45 |
| 48-0.4 | B3 | - | rock cliff (sedimentary) in part overlain by silt | silty sand low-tide beach terrace with rock platform and pebble sand beach face adjacent to the backshore | 25-50 | mud; 100 m to opposite shore | - | southeast | <1 | <45 |
| 49-0.22 | P2 | - | as unit 48 | horizontal rock platform with <50% cobble pebble beach veneer | 25-50 | mud; 900 m to opposite shore | - | south | <1 | <45 |
| | | V | - | pebble cobble beach face with rock platform adjacent to the backshore | - | - | - | | | |
| 50-0.98 | B4 | - | cliff, <1 to 5 m in height, made up of silt | pebble sand low-tide beach terrace with pebble beach face adjacent to the backshore | 40 | mud; width 1000 m | mud for 200 m; total width 600 m | southeast | 7 | <45 |
| | | V | rock island | rock island | - | - | - | | | |
| 51-0.9 | P2 | - | rock cliff, 5-20 m high (sedimentary rock) | horizontal rock platform with <50% blocky, rubbly cobble beach veneer | 25-40 | mud; 600 m to opposite shore | - | south | 15 | 50 |
| | | V1 | - | pebble beach face | | - | - | | | |
| | | V2 | - | pebbly sand low-tide beach terrace | | - | - | | | |
| | | V3 | colluvial fan, subject to mass movement (rockfall) | - | | - | - | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| S2-0.3 | P2 (.25) | P | rock cliff, 5-20 m high sedimentary rock) | rock platform with <50% beach veneer | 15-25 | width 200 m | width 600 m | northeast | 5 | 90 |
| | C (.05) | S | as above | rock cliff | 2 | as above | as above | | | |
| S3-0.19 | P3 | - | rock cliff, 1 to 10 m in height | rock platform with <50% blocky rubble beach veneer with sandy low-tide beach terrace adjacent to the subtidal | 25 | 1000 m to off-shore island; all less than -10 m | - | northeast | <1 | 90 |
| S4-0.5 | B2 (.4) | P | cliff, 1 to 5 m high, made of silt; portions protected by seawall | sandy low-tide beach terrace with sandy pebble beach face adjacent to the backshore | 25-35 | 200 to 500 m to off-shore island; all less than -10 m | - | northeast | <1 | 90 |
| | P2 (.1) | S | rock cliff, 1 to 5 m in height | rock platform with >50% sandy pebble beach veneer | 10 | as above | - | | | |
| S5-0.48 | M | - | marina | - | - | - | - | northeast | <1 | 90 |
| S6-0.38 | P2 (.28) | P | rock cliff, 1 to 10 m in height | rock platform with <50% rubble, cobble, pebble beach veneer | 20-40 | 200 to 400 m to off-shore island; all less than -10 m | - | southeast | <1 | <90 |
| | B4 (.10) | S | cliff, 1 to 5 m in height, made up of silt | sandy pebble low-tide beach terrace with pebble beach face adjacent to the backshore | 35 | as above | - | | | |
| S7-0.39 | P2 | - | rock cliff (sedimentary), 1 to 10 m in height | rock platform with >50% blocky rubble beach veneer | 10-20 | 400 m to off-shore island; all less than -10 m | - | east | 7 | 150 |
| | | V | sandy pebble beach | pebble rubble beach face | - | - | - | | | |
| S8-0.08 | M | - | boat ramp | - | width 100 m | width 100 m | - | north | 5 | 140 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 59-0.41 | P3 | - | rock cliff (sedimentary), in part overlain by silt; 1 to 10 m in height | rock platform with >50% blocky rubble beach veneer with sandy pebble low-tide beach terrace adjacent to the subtidal | 15-75 | width 100 to 200 m | width 100 m | north | 5 | 140 |
| | | V | - | sandy pebble beach face | - | - | - | | | |
| 60-0.33 | M | - | ferry terminal | - | - | - | - | north | 5 | 140 |
| 61-0.45 | P2 | - | rock cliff (sedimentary), 5 - 20 m in height | rock platform with <50% cobble, pebble, rubble beach veneer | 20-50 | width 50-100 m | width 100 m | north | 5 | 140 |
| 62-0.37 | B4 | - | rock cliff (sedimentary), 1 to 5 m in height | sandy pebble beach face | 20-25 | width 30 to 100 m | width 100 m | north | 5 | 140 |
| 63-0.2 | P3 (.11) | P | cliff, 1 to 5 m in height; shells (midden?) over till | rock platform with >50% rubble gravel beach veneer with sandy gravel beach face | 20-30 | width 100 to 250 m | width 100 m | north | 5 | 140 |
| | P2 (.09) | S | cliff, 1 to 5 m in height, interbedded silt and till | rock platform with >50% blocky rubble beach veneer | 20-30 | as above | as above | | | |
| 64-0.12 | B4 | - | cliff, 1 to 5 m in height, made up of silt and till | pebble sand low-tide beach terrace with a cobble pebble beach face adjacent to the backshore | 50 | width 100 to 300 m | 500 m to off-shore island | north | 5 | 140 |
| 65-0.95 | P2 (.65) | P | rock cliff (sedimentary), 1 to 5 m in height | rock platform with >50% blocky rubble or pebble cobble beach veneer | 15-20 | width 50 to 300 m | 100 m to -20; or 700 m to off-shore island | north | 5 | 140 |
| | B4 (.3) | S | sandy gravel cliff, 1 to 5 m in height | sandy pebble cobble beach face | 20-30 | as above | as above | | | |
| | | V1 | - | sandy pebble low-tide beach terrace with sandy pebble beach face adjacent to the backshore | - | - | - | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | V2 | - | rock platform with <50% blocky rubble beach veneer | - | - | - | | | |
| 66-1.42 | P2 (.85) | P | cliff, till over rock, 1 to 5 m in height | rock platform with <50% beach veneer ovr rock | 25-55 | width 20 to 200 m | width 50 to 200 m | north | 15 | 140 |
| | B4 (.57) | S | as above | sandy pebble low-tide beach terrace with a pebble, boulder, cobble beach face adjacent to the backshore | 55-60 | as above | as above | | | |
| 67-2.12 | P2 | - | rock cliff (sedimentary), height 1 to 10 m | rock platform with <50% blocky rubble or gravel beach veneer | 25-35 | width 20 to 100 m | width 50 to 100 m | north | 15 | 180 |
| | | V | - | sandy pebble low-tide beach terrace and face | - | - | - | | | |
| 68-0.25 | C | - | rock cliff (sedimentary); 5 to 20 m in height | rock cliff (sedimentary) | 2 | width 50 m | width 50 to 100 m | northwest | 14 | 140 |
| 69-0.35 | P2 | - | sedimentary rock cliff; 1 to 5 m in height | sedimentary rock platform | 30-100 | width 50 to 120 m | width 50 to 250 m | west | 14 | 130 |
| | | V | sandy cliff, 1 to 5 m high | pebble beach face with some beach veneer over the rock platform | - | - | - | | | |
| 70-0.42 | P2 (.4) | P | sedimentary rock cliff, 1 to 5 m high | sedimentary rock cliff with rock platform | 10-20 | width 20 to 150 m | width 100 to 120 m | south | 7 | 100 |
| | B4 (.02) | S | sandy silt cliff, 1 to 5 m high | cobble boulder low-tide beach terrace with pebble beach face adjacent to the backshore | 80 | as above | as above | | | |
| 71-0.32 | B4 | - | cliff, 1 to 10 m high, made up of silt overlying till | cobble boulder low-tide beach terrace with pebble cobble beach face adjacent to the backshore | 80-90 | sand; width 100 to 150 m | width 100 m | south | 7 | 90 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 72-0.55 | B3 (.3) | P | silt cliff, 1 to 5 m high | silty sand low-tide beach terrace with pebble cobble beach face adjacent to backshore | 40-100 | sand; width 100 to 150 m | width 100 m | | | |
| | F (.25) | S | as above | cobble pebble delta | 100-130 | | | west | 7 | 70 |
| | | V | - | rock platform with <50% beach veneer over rock | - | - | - | | | |
| 73-0.28 | P2 | - | rock cliff (sedimentary), 1 to 5 m high | rock platform with >50% cobble, pebble, sand beach veneer | 10-35 | sand; width 50 to 100 m | width 120 m | | | |
| | | V | silt cliff, 1 to 5 m high | cobble, pebble beach face with beach sediments over rock platform | - | - | - | west | 15 | 70 |
| 74-0.2 | B3 | - | cliff, 10 to 20 m, unconsolidated materials (silt, in part) over rock | silty sand low-tide beach terrace with a rock cliff and/or platform adjacent to the backshore | 100 | sand; width 200 m | width 200 m | | | |
| | | V | - | rock platform | - | - | - | west | 15 | 45 |
| 75-0.48 | P2 | - | rock cliff (sedimentary), 1 to 10 m high | rock platform with >50% cobble boulder to pebble sand beach veneer | 30-60 | sand; width 200 m | width 200 m | | | |
| | | V | marina | | | | | north | 15 | 20 |
| 76-0.13 | C | - | rock cliff, 5 to 20 m high | rock cliff | 2 | sand; width 50 to 150 m | width 120 m | northeast | 7 | 45 |
| 77-0.67 | P2 | - | rock (sedimentary) platform | rock platform, slope 5 to 15° | 25 | width 100 m | width 80 to 100 m | | | |
| | | V | - | pebble cobble low-tide beach terrace with pebble beach face | - | - | - | northwest | 15 | 140 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 78-1.3 | P3 (.75) | P | silt cliff, 1 to 5 m high | rock platform with >50% sandy cobble beach veneer and pebble beach face adjacent to the backshore | 45 | sand, width 100 to 250 m | sand, width 200 m | | | |
| | B2 (.38) | S1 | silty sand cliff, 1 to 5 m high, partially protected by a seawall | sandy beach bars with a sandy pebble beach face adjacent to the backshore | 60 | as above | as above | southwest | 14 | 180 |
| | P2 (.17) | S2 | rock cliff, 1 to 5 m high | rock platform with <50% cobble boulder beach veneer | 20 | as above | as above | | | |
| 79-0.55 | B2 | - | cliff, 1 to 5 m high, made up of silt overlying till; in part, protected by a seawall | sandy low-tide beach terrace with a sand bar and sandy pebble beach face adjacent to the subtidal and backshore, respectively | 140 | sand, width 400 m | sand, width 200 m | southwest | 14 | 160 |
| | | V1<br>V2 | -<br>- | rock platform<br>sandy pebble delta | -<br>- | -<br>- | -<br>- | | | |
| 80-0.69 | P2 (.51) | P | cliff made up of silt overlying igneous rock, 1 to 5 m high | rock platform with <50% rubble, sand, cobble beach veneer | 35-60 | sand, width 200 m | sand grading to mud, width 200 to 500 m | southwest | 13 | 180 |
| | B4 (.18) | S | as above | sandy cobble low-tide beach terrace with sandy pebble beach face adjacent to the backshore | 60 | as above | as above | | | |
| 81-0.91 | P3 (.5) | P | cliff, 1 to 5 m high, made up of silt overlying till | rock platform with <50% rubble beach veneer with a pebble cobble low-tide beach terrace adjacent to the subtidal | 60-110 | muddy sand; width 200 to 300 m | sand, width 200 m | | | |
| | B2 (.41) | S | cliff, 1 to 5 m high, silt overlying till | sandy low-tide beach terrace with sandy cobble pebble beach face adjacent to the backshore | 90 | as above | as above | south | 13 | 110 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | V1<br>V2 | seawall<br>- | -<br>rock platform | -<br>- | -<br>- | -<br>- | | | |
| 82-0.3 | B2 | - | sandy silt cliff, 1 to 5 m high; partially protected by a seawall | sandy low-tide beach terrace with sandy cobble beach face adjacent to the backshore | 110-120 | muddy sand, width 350 to 380 m | sand, width 300 m | southwest | 10 | 90 |
| 83-0.44 | D | - | as unit 82 | sandy pebble delta | 105-115 | as unit 82, | as unit 2 | southwest | 10 | 90 |
| 84-0.9 | B3 | | cliff, <1 to 5 m high, made up of silt; in part protected by a seawall | silty sand low-tide beach terrace with sandy bars and pebble cobble beach face adjacent to the sub-tidal and backshore, respectively | 200-205 | muddy sand, width 500 m | sand; width 350 m | | | |
| | | V1<br>V2 | -<br>- | rock platform<br>silty gravel over silty sand delta | -<br>- | -<br>- | -<br>- | west | 7 | 110 |
| 85-0.23 | M | - | wharf, boat ramp, jetty | silty sand low-tide beach terrace | 50 | muddy sand, width 400 m | sand, width 400 m | northwest | 7 | 80 |
| 86-1.55 | P2 (.85) | P | cliff, 1 to 10 m high, made of rock and silt overlying rock | rock platform with <50% cobble pebble beach veneer | 50 | sand; width 100 to 180 m | sand; width 100 to 200 m | | | |
| | P3 (.7) | S | as above | sandy gravel low-tide beach and rock platform with cobble pebble beach face adjacent to the backshore | 65 | as above | as above | northwest | 16 | 150 |
| 87-1.1 | P3 | - | cliff, sandy silt overlying igneous bedrock, 1 to 10 m high | rock platform with low-tide sandy gravel beach terrace and discontinuous cobble pebble beach face adjacent to the sub-tidal and backshore respectively | 40-65 | sand, width 20 to 100 m | sand or mud; width 80 to 100 m | northwest | 16 | 180 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 88-1.15 | P2 | P | cliff, made up of rock or silt over rock, 1 to 5 m high; in part protected by seawalls | rock platform with >50% blocky rubble to cobble pebble beach veneer | 10-35 | sand; width 20 to 100 m | sand; width 100 to 150 m | west | 17 | 180 |
| | P2 | S | as above | rock platform | 10-35 | as above | as above | | | |
| | | V | silt cliff, 1 to 5 m high, in part protected by seawall | sandy pebble low-tide beach terrace and pebble gravel beach face adjacent to the backshore | - | - | - | | | |
| 89-0.32 | P2 (.24) | P | cliff, silt overlying rock, 1 to 5 m high | rock platform with >50% blocky rubbly beach veneer | 15-20 | sand, width 30 to 100 m | sand, width 50 to 125 m | south | 10 | 60 |
| | C (.08) | S | rock cliff (igneous), 1 to 5 m high | rock cliff | 2 | as above | as above | | | |
| 90-0.19 | B4 | | silt cliff, 1 to 5 m high; in part protected by a seawall | sandy gravel low-tide beach terrace with a sandy pebble beach face adjacent to the backshore | 30-40 | sand, width 80 to 120 m | sand, width 200 m | south | 10 | 50 |
| 91-0.52 | P2 | | cliff, mostly rock with some silt over rock, 1 to 5 m high | rock platform with <50% blocky rubble to sandy pebble beach veneer | 20-30 | sand, width 20 to 50 m | sand, width 200 m | south | 10 | 30 |
| 92-0.34 | B2 | | cliff, 1 to 5 m high, shells (midden) overlying silt | sand or pebbly sand low-tide beach terrace with sandy pebble beach face adjacent to the backshore | 105-125 | sand, width 150 m | sand, width 300 m | | | |
| | | V1<br>V2 | rock cliff (igneous)<br>- | rock platform (igneous<br>sandy pebble delta | -<br>- | -<br>- | -<br>- | southwest | 7 | 35 |
| 93-0.3 | P3 | - | rock cliff (igneous); 1 to 5 m high | rock platform with >50% rubble beach veneer and a sandy pebble low-tide beach terrace adjacent to the subtidal | 50-60 | sand, width 100 m | sand, width 300 m | | | |
| | | V1<br>V2 | -<br>- | rock platform<br>sandy gravel delta | -<br>- | -<br>- | -<br>- | west | 7 | 40 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 94-1.68 | P3 | - | rock cliff (igneous), 1 to 5 m high | beach veneer over rock platform with a sandy pebble low-tide beach terrace adjacent to the subtidal | 20-30 | sand, width 50 to 100 m | sand, width 50 to 100 m | northwest | 19 | 100 |
| | | V1<br>V2 | -<br>- | rock platform<br>sandy pebble delta | -<br>- | -<br>- | -<br>- | | | |
| 95-1.33 | P2 (.75) | P | rock cliff (igneous), 1 to 20 m high | rock platform with >50% blocky rubble to cobble pebble beach veneer | 10-20 | sand, width 50 to 80 m | sand grading to mud; width 30 to 80 m | west | 20 | 180 |
| | C (.58) | S | rock cliff (igneous), 1 to 20 m high | rock cliff | 2 | as above | as above | | | |
| | | V1<br>V2 | cliff, unconsolidated material, 1 to 5 m high<br>wharf | sandy pebble beach low-tide terrace and face<br>- | -<br>- | -<br>- | -<br>- | | | |
| 96-0.22 | B5 | - | rock cliff with blocky rubble talus at base | blocky rubble beach | 5-12 | sand, width 40 m | sandy, 180 m to opposite shore | south | 7 | 55 |
| 97-0.8 | D | - | cliff, 1 to 5 m high | sandy pebble delta | 20 | sand, width 180 m | sand, width 220 m | west | 3 | 40 |
| 98-2.68 | P2 (2.5) | P | rock cliff, 1 to 20 m high | rock platform | 10-30 | sand, 200 m to opposite shore | - | northwest | 20 | 60 |
| | M (.18) | S | seawall, wharf | - | - | - | - | | | |
| 99-0.55 | P2 (.3) | P | rock cliff (igneous), 1 to 20 m high | rock platform with <50% blocky rubble to cobble beach veneer | 10-30 | sand or mud; width 20 to 500 m | sand or mud; width 50 to 100 m | southwest | 6 | <180 |
| | C (.13) | S1 | as above | rock cliff | 2 | as above | as above | | | |
| | B4 (.12) | S2 | silt cliff, 1 to 5 m high | sandy pebble low-tide beach with pebble rubble beach face | 20-30 | as above | as above | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 100-1.02 | P3 | - | cliff, 1 to 5 m high, made up of silt overlying igneous rock | rock platform with <50% blocky rubble to cobble pebble beach veneer with a cobble pebble low-tide beach terrace adjacent to the subtidal | 10-30 | sand; width 70 to 200 m | sand; width 80 to 100 m | southwest | 7 | 120 |
| 101-0.08 | D | - | cliff, 1 to 5 m high, made of silt | sandy pebble delta | 90-130 | sand; width 80 m | sand; width 180 m | west | 5 | 70 |
| 102-0.25 | P3 | - | cliff, 1 to 5 m high, silt overlying igneous rock | rock platform with <50% pebble gravel beach veneer with sandy pebble low-tide beach terrace adjacent to the subtidal | 30-45 | sand; width 200 m | sand; width 50 m | west | 5 | 90 |
| 103-0.75 | B4 (.4) | P | cliff, 1 to 5 m high, made up of sandy gravel overlying silt | pebble sand to sand low-tide beach terrace with minor rock platform and sandy pebble beach face adjacent to the backshore | 40-45 | sand; width 200 m | sand; width 50 m | northwest | 11 | 100 |
| | P2 (.35) | S | cliff, 1 to 5 m high, sandy gravels over silt over rock | rock platform with <50% blocky rubble beach veneer | 30-6 | as above | as above | | | |
| | | V | boat ramp | - | - | - | - | | | |
| 104-0.35 | P2 (.3) | P | rock cliff, <1 to 5 m high | rock platform <50% sandy pebble beach veneer | 5-18 | width 20 to 150 m | width 50 to 80 m | west | 12 | 180 |
| | P3 (.05) | S | as above | as above with pebble beach face adjacent to the backshore | 30 | as above | as above | | | |
| | | V1 | cliff, 1 to 5 m high, silt over rock | sandy low-tide beach terrace with pebble beach face | - | - | - | | | |
| | | V2 | - | rock cliff | - | - | - | | | |
| | | V3 | | rock platform with <50% beach veneer | - | - | - | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 105-1.05 | B4 (.8) | P | cliff, 1 to 5 m high, made of silt and gravel | pebble sand low-tide beach terrace with pebble sand beach face adjacent to the backshore | 15-30 | width 50 to 200 m | width 80 to 100 m | west | 5 | 120 |
| | D (.25) | S | as above | sand gravel delta | 80-115 | as above | as above | | | |
| | | V | seawall, marina, wharf | - | - | - | - | | | |
| 106-0.7 | B5 | - | rock cliff, 5 to >20 m high | blocky rubble beach | 3-10 | width 80 to 100 m | width 50 to 100 m | northwest | 13 | 40 |
| | | V1 | unconsolidated cliff, 1 to 5 m high | low-tide beach terrace and face | | - | - | | | |
| | | V2 | - | rock platform with <50% beach veneer | | - | - | | | |
| 107-0.41 | B2 | - | cliff, 1 to 5 m high, silt over sandy gravel | sand low-tide beach terrace with gravel sand beach face adjacent to the backshore | 10-30 | width 250 m | width 50 m | | | |
| | | V | rock cliff | rock platform | - | - | - | northwest | 15 | 20 |
| 108-.1 | C | - | rock cliff, 5 to 20 m high | rock cliff | 2 | width 100 m | width 60 m | north | 3 | 50 |
| 109-1.02 | B4 (.82) | P | cliff, 1 to 20 m high, made up of sand and gravel | sandy pebble beach face | 15 | 100 to 200 m to opposite shore | - | | | |
| | P2 (.2) | S | rock cliff, 1 to 5 m high | rock platform <50% blocky rubble beach veneer | 15 | as above | as above | west | <1 | 90 |
| 110-0.38 | B3 | - | cliff, pebble sand over silt, 1 to 5 m high | silty sand low-tide beach terrace with a pebble sand beach face adjacent to the backshore | 10-15 | 250 m to opposite shore | - | southwest | <1 | 30 |
| 111-0.38 | D | - | silt cliff, 1 to 5 m high | muddy to gravel mud delta with multiple channels | 65-160 | 800 m to opposite shore | - | west | <1 | 70 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 112-2.2 | B4 (1.2) | P | rock cliff, 1 to 20 m high | sandy gravel beach face | 15 | 100 to 200 m opposite shore | - | east | <1 | 90 |
| | B5 (1.0) | S | rock cliff, 1 to 20 m high | blocky rubble beach with some rock platform | 5-15 | - | as above | | | |
| | | V1 | - | delta | - | - | - | | | |
| | | V2 | - | pebble gravel low-tide terrace | - | - | - | | | |
| 113-1.1 | C (.7) | P | rock cliff, 1 to 10 m in height | rock cliff | 2 | width 10 to 50 m | width 50 to 100 m | north | 20 | 110 |
| | P2 (.4) | S | cliff, mostly rock with sandy rubble over rock, 1 to 10 m high | rock platform with <50% cobble pebble beach veneer | 6-11 | as above | as above | | | |

123° 30' 00"
48° 42' 30"

SATELLITE CHANNEL

COLBURNE PASSAGE

Cloake Hill

Horth Hill

DEEP COVE

PATRICIA BAY

SAANICH

TSEHUM HR.

ROBERTS BAY

SIDNEY

PHYSI
OF

123° 17'30"

48° 42'30"

# PHYSICAL SHORE-ZONE ANALYSIS OF THE SAANICH PENINSULA

D.E. Howes[1] and J.R. Harper[2]

## 1. Map Symbols and Explanation

| | |
|---|---|
| 31 | Shore unit number; for definition and description refer to SHORE UNIT DESCRIPTIONS. |
| P | Primary subunit of a shore unit; accounts for >50% of unit length. |
| S | Secondary subunit(s) of a shore unit, accounts for <50% of unit length. |
| V | Variant, represents minor shoreline feature(s) less than 10% in total of unit length. |
| ═══ | Boundary between shore units. |
| ——— | Boundary between primary and secondary subunits. |
| ➡ | Net (annual) intertidal sediment transport direction; portions of shoreline without arrows indicate net transport direction is not known. |
| ▭ | Shore type symbol; for description of the major types refer to SHORE TYPE DESCRIPTIONS. |
| —20— | Isobath; depth in metres below the lower low water line for large (spring) tide. |
| ..... | Approximate lower low water line for large (spring) tide. |

## 2. Shore Type Descriptions

The shore units of the Saanich Peninsula have been generalized into 12 SHORE TYPES. They were grouped on the basis of their intertidal form and character of material, the presence or or absence of an eroding backshore cliff, and their intertidal width.

### CLASTIC SEDIMENT SHORE TYPES

BROAD SANDY BEACH-ERODING BACKSHORE CLIFF

**B1** Intertidal sandy beach, 80 to 260 m wide, with a backshore cliff, >10 m high, made up of interbedded unconsolidated materials (silt, sand, gravel, till) undergoing modification by mass movements (slumps, slides).

BROAD SANDY BEACH

**B2** Intertidal sandy beach, 60-400 m wide, with a backshore cliff or occasionally, a beach berm; the cliff is usually made up of silt, of variable height (1-20 m) and at a few sites, is being undercut by waves.

BROAD SILTY SAND BEACH:

**B3** Intertidal silty sand beach, 75 to 340 m wide, with a backshore cliff, less than 5 m high, made up of silt or occasionally, sand or sandy gravel.

NARROW TO BROAD MIXED BEACH:

**B4** Intertidal sandy gravel to gravel beach, 15 to 80 m wide, with a backshore cliff or infrequently, a beach berm; the cliff is usually <5 m high, made up of silt or till, or both.

NARROW RUBBLE BEACH

### ROCK SHORE TYPES

BROAD ROCK PLATFORM WITH BEACH VENEER

**P1** Intertidal rock platform, 60 to 100 m wide, overlain by a variable amount (30-70%) of bouldery cobble or blocky beach veneer (<1 m thick); the backshore usually consists of a rock cliff, 1 to 5 m high.

NARROW ROCK PLATFORM WITH BEACH VENEER

**P2** Intertidal rock platform, 5 to 60 m wide, overlain by a variable amount (30-70%) of blocky rubble or gravel beach veneer (<1 m thick); the backshore usually consists of a rock cliff, occasionally overlain by till or silt, and is up to 20 m high.

CLIFF

**C** Intertidal rock cliff, <2 m high; the backshore consists of a rock cliff, 5 to 20 m high.

### ROCK AND SEDIMENT SHORE TYPES

ROCK PLATFORM AND BEACH SEDIMENTS

**P3** Intertidal rock platform, 10 to

PATRICIA BAY

SAANICH INLET

SIDNEY

BAZAN BAY

Yarrow Point

Coles Bay

Mt. Newton

OUTLET (STORM)

Cordova Channel

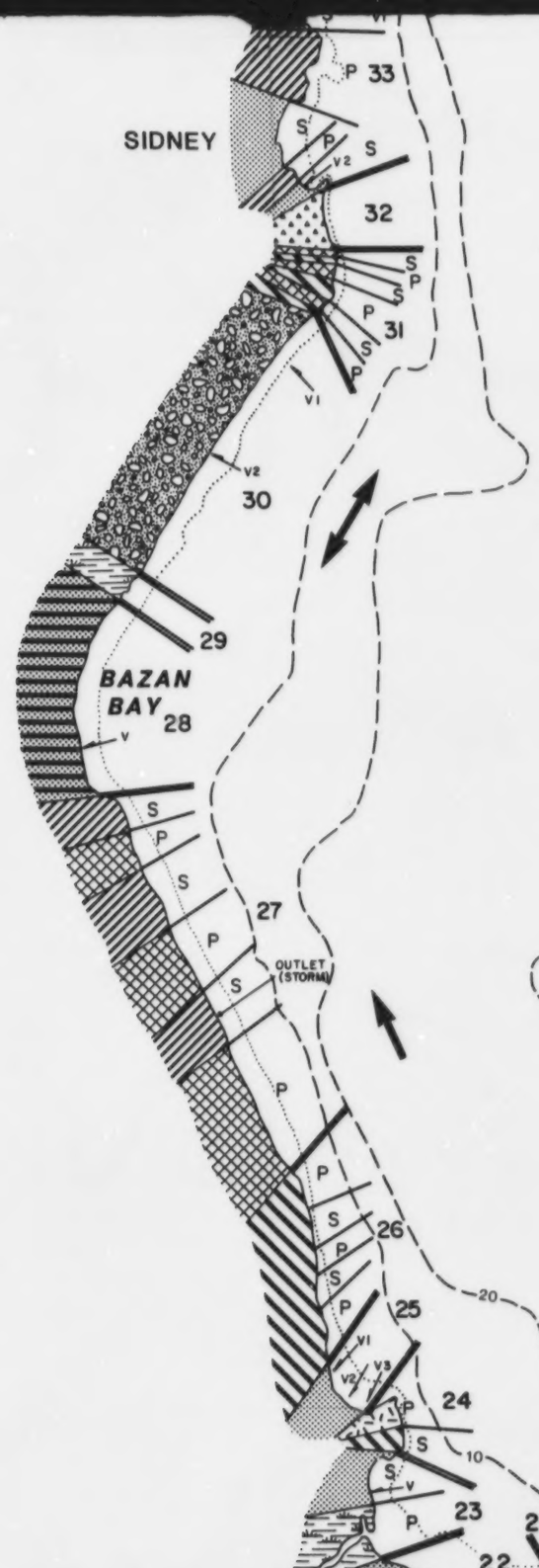
JAMES

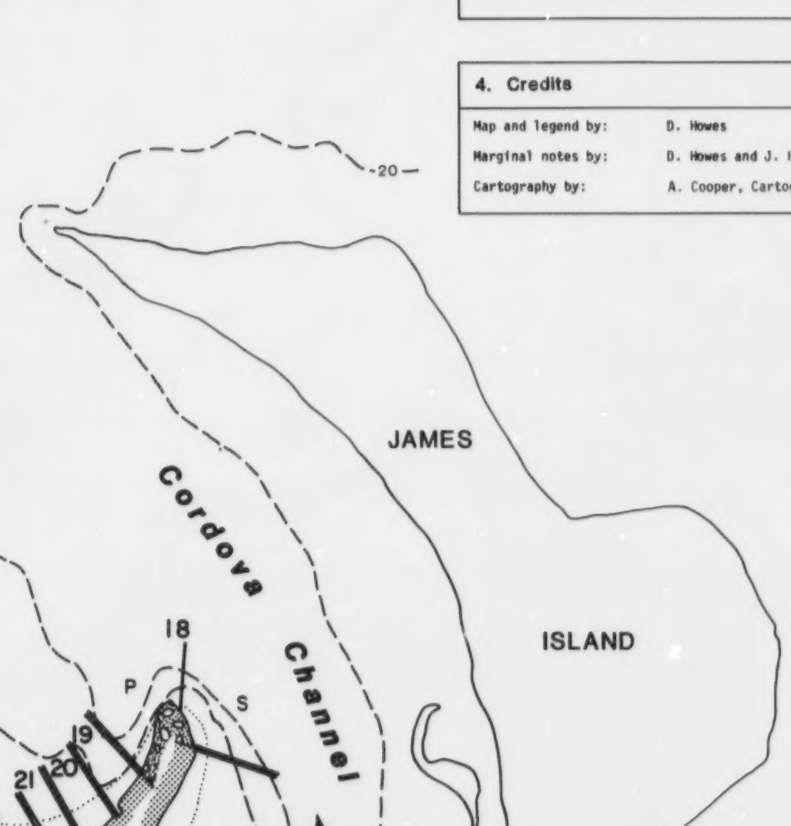
84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 S1 S2

27 28 29 30 31 32 33

18 19 20 21 22 23 24 25 26

10 20




B3 Intertidal silty sand beach, 75 to 340 m wide, with a backshore cliff, less than 5 m high, made up of silt or occasionally, sand or sandy gravel.

NARROW TO BROAD MIXED BEACH:

B4 Intertidal sandy gravel to gravel beach, 15 to 80 m wide, with a backshore cliff or infrequently, a beach berm; the cliff is usually <5 m high, made up of silt or till, or both.

NARROW RUBBLE BEACH

B5 Intertidal blocky rubble beach, 3 to 15 m wide, with a backshore cliff made up of rock, sometimes with talus materials, 5 to >20 m high.

BROAD MUDFLAT

F Intertidal flat (<5°), 150 to 700 m wide, made up of silty sand or silt with a low backshore cliff, (<5 m high) made up of silt.

BROAD DELTA

D Intertidal delta, 80 to 240 m wide, made up of sandy pebble gravel and occasionally, cobble pebble gravel with a backshore cliff, 1-5 m high, made up of silt.

CLIFF

C Intertidal rock cliff, <2 m high; the backshore consists of a rock cliff, 5 to 20 m high.

ROCK AND SEDIMENT SHORE TYPES

ROCK PLATFORM AND BEACH SEDIMENTS

P3 Intertidal rock platform, 10 to 100 m wide, overlain by a variable amount (30-70%) of blocky rubble or gravel beach veneer and beach sediments made up of sand or gravel, or both; the backshore consists of either a rock or silt cliff, 1 to 10 m high.

MAN SHORE TYPES

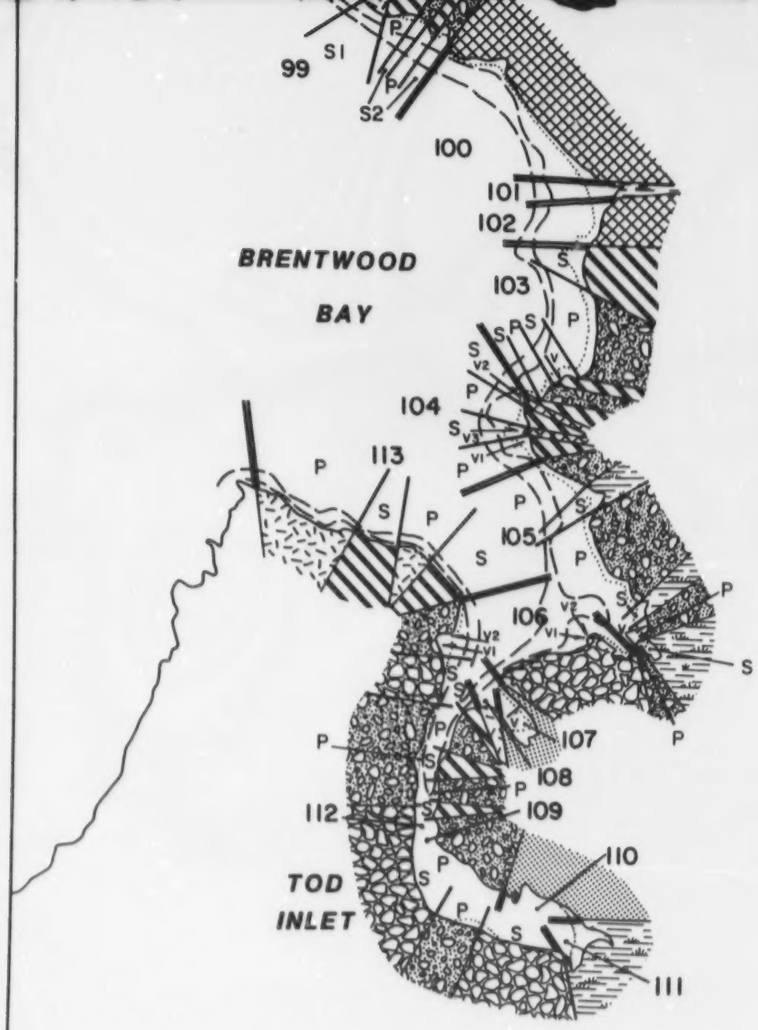
M Man-modified units; includes marinas, wharfs, seawalls, boat ramps and ferry terminals.

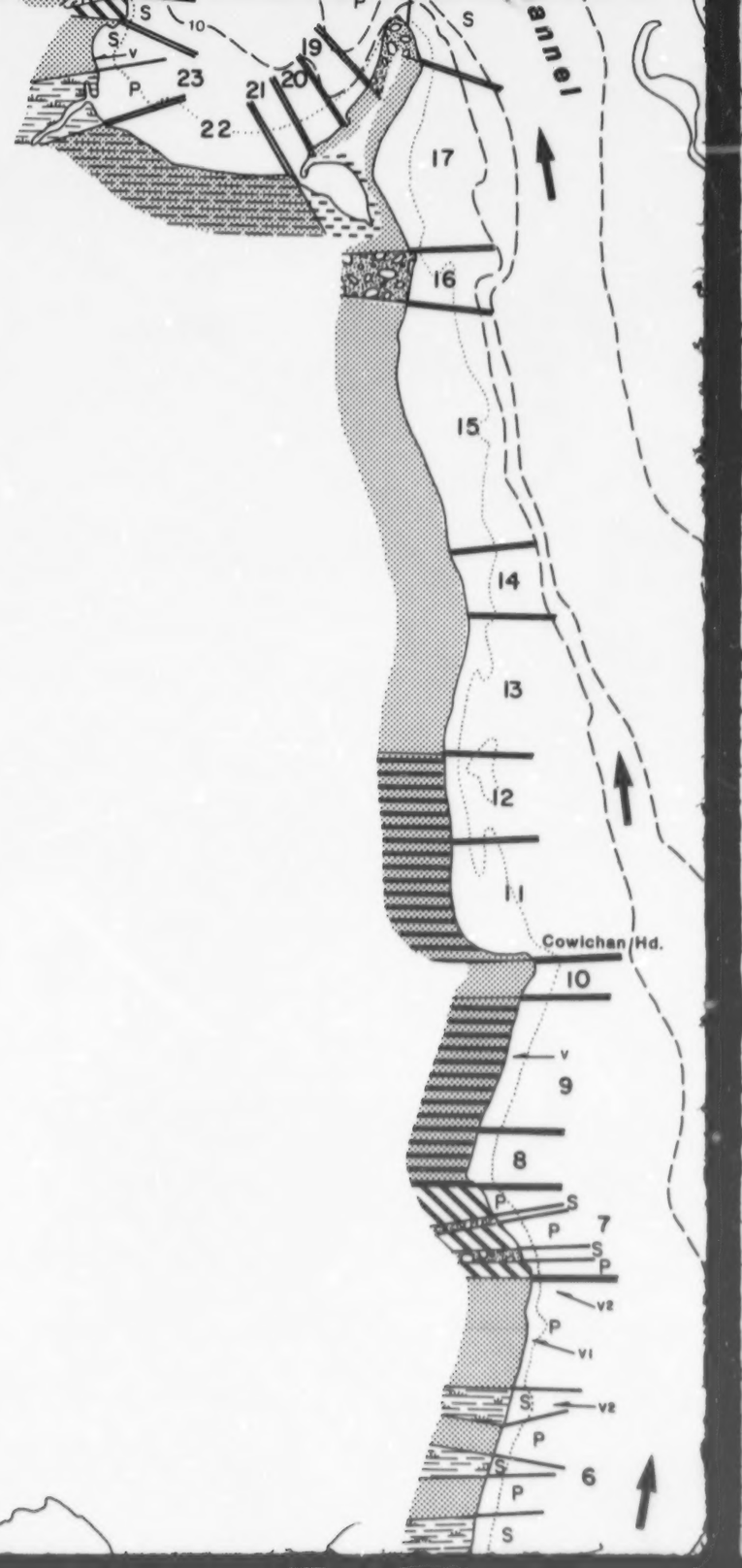
## 3. Shore Unit Descriptions

***For a description of each shore unit refer to the Appendix (Shore Unit Description Table) in the accompanying report.***

## 4. Credits

| | |
|---|---|
| Map and legend by: | D. Howes |
| Marginal notes by: | D. Howes and J. Harper |
| Cartography by: | A. Cooper, Cartography Section, Surveys and Resource Mapping Branch |


BRENTWOOD
BAY
TOD
INLET
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
S1
S2
P
S
V1
V2
V3


Cowichan Hd.
10
9
8
7
6
5
4
3
2
1
11
12
13
14
15
16
17
18
19
20
21
22
23
S
P
V
V1
V2

Tunnel

S

V

P

23

22

21

20

19

10

17

16

15

14

13

12

11

Cowichan Hd.

10

V

9

8

P

S

7

P

S

P

V2

P

V1

S

V2

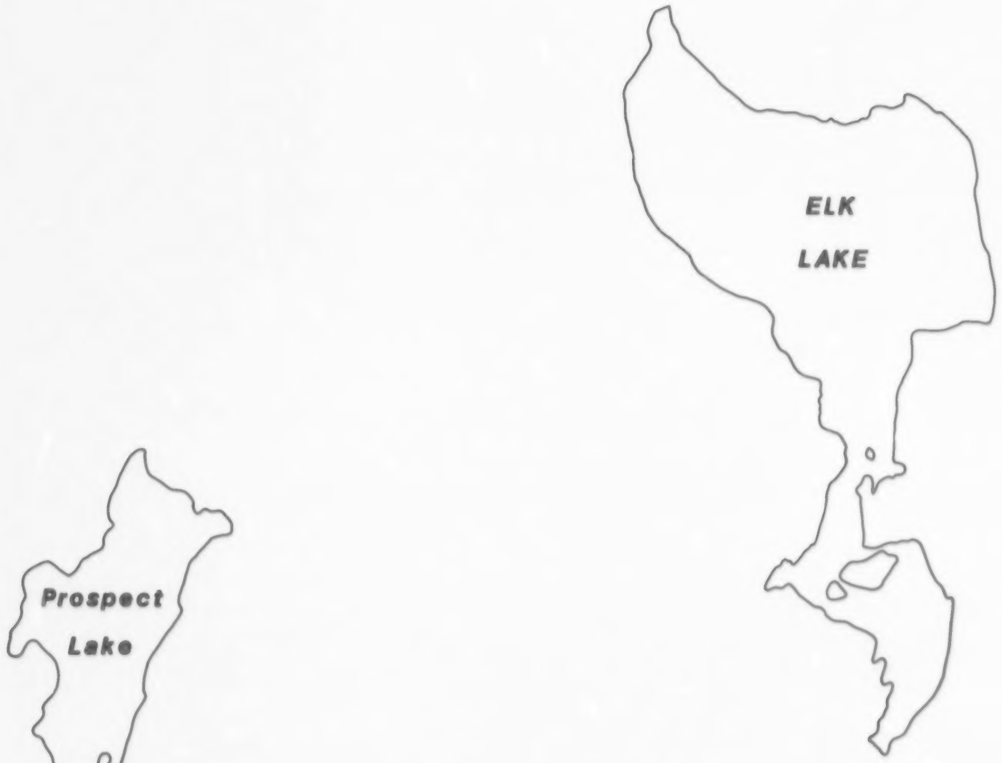
P

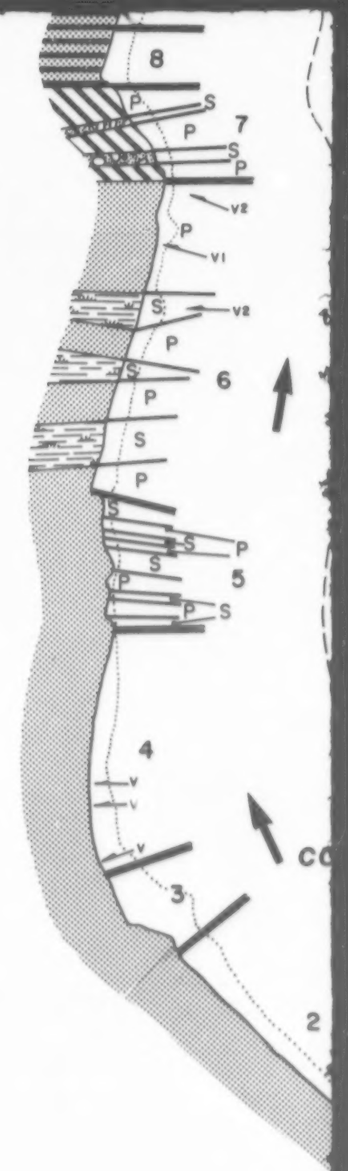
S

6

P

S




48°30'00"
123°30'00"

48°29'30"
123°22'30"

*Drafting services provided by Surveys and Resource Mapping Branch, Ministry of Environment, Victoria, B.C., 1984.*

Scale 1:25,000

[1] *Surveys and Resource Mapping Branch, Ministry of Environment, Victoria, B.C.*

[2] *Dobrocky Seatech Ltd., Sidney, B.C.*

M-000

ELK

LAKE

ospect

Lake

8

7

6

5

4

3

2

1

P

S

V1

V2

V3

V

CORDOVA

BAY

20

10

48°29'30"

123°22'30"

123°17'30"

le 1:25,000

[1] Surveys and Resource Mapping Branch, Ministry of Environment, Victoria, B.C.

[2] Dobrocky Seatech Ltd., Sidney, B.C.